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Linda Candy
Sam Ferguson *Editors*

Interactive Experience in the Digital Age

Evaluating New Art Practice

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Foreword

While the connections between the arts and digital technologies can be traced back over decades, it is the phenomenal diversification of the computer interface over recent years which has driven the explosion of interest in interactive arts. The emergence of immersive, mobile, wearable, tangible, gestural, embedded, intelligent, autonomous, adaptive, social, networked – the list seems endless – technologies provides digital artists with a rich palette from which to create their art. This, of course, serves to transform the nature of the art that is created, with viewers becoming spectators, with artworks becoming experiences, and with increasing blurring between genres and forms as an inevitable consequence of digital technology's inherent tendency to transgress conventional boundaries.

Into this maelstrom steps the Human Computer Interaction (HCI) practitioner. While artists' interest in the world of computing initially focused on rendering graphics and sound, they are now turning their gaze to the challenges of interaction design. Artists need to design compelling user experiences; and ones that can stand up against the increasingly sophisticated quality of design delivered through our everyday smartphones, gaming consoles and sometimes even our humble personal computers.

In their turn, HCI researchers appear to be fascinated by the digital arts as a new (to them) and challenging playground for their craft. The Arts raise new and unusual challenges for HCI, may innovate unusual approaches, and, of course, are as deserving of HCI's attention as any other aspect of our digital lives. It is no surprise then that leading HCI conferences and journals are excited by the digital arts, launching special interest groups, special issues and publishing a growing number of papers that report on artistic experiences and issues from 'the field'.

It is therefore very exciting to see this book published at the present time. Never has there been a greater need to explore the boundary between the digital arts and interactive experience design. Artists need to understand the new challenges that they face, HCI practitioners need to appreciate the distinctiveness of the digital arts, and the increasing number of researcher-practitioners whose work cuts across both

fields must be able to navigate their way through unchartered interdisciplinary waters. The breadth of this book, both in terms of the artistic forms that it covers, but also the issues it tackles – and especially its focus on the critical challenge of evaluation – offers a major contribution to this movement. It will be of great interest to artists, interaction designers and researchers alike, and especially to those who increasingly find themselves spanning these endeavours.

Nottingham, UK Steve Benford

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Sam Ferguson is a lecturer at the University of Technology, Sydney, and a member of the Creativity & Cognition Studios. His focus is to understand the relationship between sound and music and human beings, and he has published widely in diverse areas such as sonification, emotion, interaction design, loudness and music research.

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Rob Saunders is a senior lecturer of the Faculty of Architecture, Design and Planning, University of Sydney. His research explores the role of curiosity in creative processes by developing computational model for personal and social creativity. Working with artists and designers, he applies his research in creative support software, interactive installations and robotic artworks.

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Chapter 1
Interactive Experience, Art and Evaluation

Linda Candy and Sam Ferguson

Abstract Art in the early twenty-first century is increasingly an interactive experience that is shared with others and in public. The use of digital technology in the arts has been used to transform the viewer into a participant and is similarly starting to transform our expectations of the experience of art. From visual and sound art to performance and gaming, the boundaries of what is possible for creativity, curatorial design, performance and exhibition are continually extending and, as a consequence, propelling the practitioners involved to examine and evaluate their practices and products as contributions to a greater understanding of the nature of interactive experience. This book, *Interactive Experience in the Digital Age,* explores the development of interactive digital art through the eyes of the practitioners who are embedding evaluation in their creative processes. Many of the interactive art system developments and the methodologies presented are relevant to the wider concerns of Human Computer Interaction as well as within the Digital Arts community. Contributors have been informed by research methods from several disciplines and have adapted them in novel ways in order to develop new strategies and techniques for assessing the experience of interactive art. With contributions from artists, curators, designers, business entrepreneurs, technologists and scientists engaged in the creative arts, this book is intended to inform, inspire and stimulate other researchers and practitioners to explore further the novel and challenging developments taking place in this field.

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1.1 Introduction

In this digital age, the public is increasingly drawn to the seductive power of computer technology and its ubiquitous presence in daily life to such an extent that it is sometimes assumed that there is no more to be done, and that somehow the communication devices and gadgets we take for granted have always been there and will continue to provide us with access to new experiences. And yet we have hardly started when it comes to understanding how interactive technologies are transforming the nature of our experience. Nowhere is this more so than in art.

People everywhere are encountering art installations and performances that invite their participation in a way not usual in the traditional art gallery or theatre space. Art is not only becoming more accessible and popular, as the sell out of major exhibitions demonstrates, it is also becoming more 'demanding' in a different sense to that of traditional art appreciation. Instead of learning about the art by prior study or listening to recordings as you follow a prescribed route through a gallery, visitors often find themselves part of the art itself, a participant in an unpredictable, surprising and intriguing situation. Moreover, some kinds of this form of art 'behave' in ways that are only possible because of the arrival of powerful interactive technologies and the ingenuity of creative practitioners who know how to design and construct such works.

Art as *experience*, as distinct from art as *artefact or object*, is steadily making inroads into public consciousness and, quietly as yet, influencing the norms of the wider art world. The widely held belief that art is primarily about creating objects and exhibiting them in galleries or selling them on the market is not likely to disappear entirely with the arrival of interactive art, but there is already a shift in public expectations about what is possible within an art exhibition, representing a natural evolution of the participative art that emerged in the 1960s. The agenda is changing and, although digital interactive art is in its infancy compared to the long tradition of mainstream art, audiences are demonstrating an increasing appetite for novel and surprising experiences both inside and outside of exhibiting spaces.

Art in the digital age is often still a private personal experience, but it is also often an experience that is shared with others and on public view. It has become more 'observable' because audiences as participants in both the creation and the evaluation of the art experience are being invited to reveal their actions and to voice their views. It is also now possible to facilitate shared experience through art systems and to study shared experience more easily in the context of research carried out by artists themselves. These practitioner researchers are including evaluation in their practice and, in doing, so establishing a new agenda for art and technology research. The digital artist in particular is concerned with the affective power of interaction rather than the more utilitarian concerns of interaction designers making products that support tasks in the work place and home.

And yet digital artists and interaction designers share a common ground. The boundaries between the Digital Arts and Human Computer Interaction are not only crossed over, but also frequently moved or *re*moved altogether, as people from

different disciplines collaborate in the development of new forms of interactive art systems and new frameworks and methods for evaluation.

This common ground, and how it is being transformed, is the subject of this book.

1.2 Themes and Methodologies

Interactive Experience in the Digital Age explores diverse ways of creating and evaluating interactive art by contributors who all have an interest in exploring ways of using digital technologies in their work. A general theme running through the different scenarios described is the relationship between the interactive arts, audience participation and engagement, and experience design in public art. Many of the interactive art developments are also of interest to interaction designers and the methodologies used can be beneficially applied in both Human Computer Interaction research and the Digital Arts. One of the key aspects of the common ground they occupy is the importance of the context: for HCI researchers, this involves attention to the situated nature of digital technology research; for the Arts, this implies the working practices of the artists and performers. In both scenarios, the role of evaluation extends beyond focusing on the attributes of the artwork or artefact itself to the context of use and all the multiple layers of participative experience this implies.

A majority of topics in this book are practitioner derived rather than being defined by research goals and therefore the importance of keeping creative practice and research tied closely to the needs of practice is evident. There can be tensions between these different agendas where goals and methods are not compatible and one of the interesting features of this inter-disciplinary work is how these differences are resolved in collaborative situations. Practitioner strategies include the application of user-centred iterative design and development approaches, but with a clear difference from product design, which traditionally takes account of user preferences but not necessarily the impact of technology on performers' practices. The research described here mostly takes place in real world situations ('in vivo') outside the laboratory, although for some well-defined tasks, 'in vitro' data collection can be appropriate. The public art environments that feature in a number of these cases, are complex and multi-layered and therefore, not easy to control, but this is not avoidable if artists wish to understand the way that audiences behave when engaging with their works in public places, such as galleries, museums and performance spaces.

The subjects of the chapters to follow include:

- interactive experience and interactive art systems in relation to traditional aesthetic categories and artistic practice and the tension between the autonomous artist and the interactive artist;
- interactive system-based artworks that exhibit autonomous behaviours in an interactive context;
- ways in which artists approach working with adaptive systems and observe audiences to improve their art system designs;

- performance practices involving artists and audiences interacting in body-focused aesthetic experiences mediated by digital technologies that explore the interactions between physiological processes;
- interaction in networked improvisatory musical performance and the approaches taken by musicians when navigating a networked experience;
- audience responses that emerge through interaction with works designed for collective experience;
- theories of emotion and the state of the art in emotion evaluation for interactive digital art;
- experiences of artists and HCI researchers exhibiting interactive artwork and unique opportunities offered by a public art events for research goals;
- evaluating the audience interaction with a collaborative interactive music system in a public exhibition;
- evaluation of a public exhibition of drawings, paintings and interactive digital works by curators, artists and gallery personnel;
- collaborative creation and evaluation of a public digital media exhibition located outdoors;
- curatorial design of digital art in museum and public art contexts and the methodologies for the presentation of new forms of interactive artworks;
- experience of performing Digital Arts entrepreneurship and how evaluation is vital to turning creative ideas into business opportunities.

1.3 Evaluating Interactive Experience

Evaluation in the creation and experience of interactive art and its implications for practitioner research is a central theme that runs through all the contributions to this book. Evaluation involves establishing the value or worth of something or some process and may be carried out using informal as well as formal approaches: for example, using expert judgement criteria or systematic research studies. The evaluation exercise is tailored to a given context and the outcomes are intended for it, but it can also provide insights that can be applied more broadly. Evaluation as practised in many of the projects described in this book has a *formative* role that is directed towards improving practices and procedures as well as outcomes.

The need for evaluation here arises from the transformative nature of experience in art and the way that interactivity in the digital age has changed the audience from viewer to a new kind of participant. The approaches described illustrate the diversity to be found in interactive arts evaluation processes from documented reflective practice to evidence based methods.

This diversity is reflected in topics such as:

- what evaluation means in the context of art experience and interaction and how it runs counter to traditional views of evaluation in art;
- how evaluation plays a formative role in creating the art system or art work through making reflective practice and thinking explicit;

- evaluation that informs the creative process enables the artist as maker to understand the relationship between artworks and different degrees of audience engagement;
- understanding art experience sometimes requires systematic methods for gathering evidence about levels of engagement in support of principled evaluation;
- quantitative methods for identifying patterns of interaction and observational data yielding qualitative information about situational factors are used in parallel to achieve a rounded, richer picture of interactive art experience.

These approaches are usually dependent upon how well they serve the creative intentions and aims of the practitioners involved, including the way works are designed and made, rather than the requirements of research for its own sake.

1.3.1 Benefits of Evaluation

Understanding art better has different implications to those of typical research outcomes. Far from constricting ideas, it is likely that any new knowledge about ways of understanding art will result in new and different forms of art being produced. For many areas, the principles and factors under investigation are fixed – research into physics for instance can rely on the principles of physics that are discovered to be unchanging, or very rarely changing, and can test those principles through repeated experiments. However, for research into art and art evaluation, a fundamental principle of much scientific research, *repeatability*, is not the aim and nor is it likely to be strictly possible. The second experience of an art object is often not like the first, for an individual, a community or a historical or geographical context, so studies may give different answers each time they are applied. When an artist explores the way interaction with a particular work takes place, through observational or interview studies, the results may offer indications as to whether or not the intended effect has been achieved within a given set of conditions in a specified time frame for that particular work. The artist gains insight into how the art 'experiment' worked – or not – as the case may be, but this does not necessarily lead to doing more of the same. Any discovered principles concerning some particular aspect of an art object are likely to prompt deconstruction and innovation, rather than conformity within that particular aspect (Gaver 2012). It is not necessary, therefore, to fear that art evaluation will be able to codify and therefore constrain an artist to a particular way of making art – rather it is likely to provide multiple novel viewpoints and tools for artists and others to employ towards developing their work along the lines of their planned outcomes and purpose.

1.3.2 Outcomes from Evaluation

There are two types of outcomes presented in this book: new understandings and new art works or art systems.

What do artists and others understand better as a result of evaluating interactive experience?

The outcomes of audience experience studies should be regarded as exploratory in nature, often raising even more questions at the same time as they provide answers to the ones initially posed. In some respects, it is only possible to *evaluate* experience within the bounds of the particular context under scrutiny.

Overall, the studies reported in this book indicate that there is a high degree of variability and fluidity in audience response and levels of engagement with the interactive work. The contributors to this book do not claim to provide definitive answers (i.e. generally applicable across all cases) to questions about how audiences behave with or respond to a particular work, or how to make one kind of artwork more effectively than another. Rather they offer novel ways of developing highly creative art experiences, as well as describing the methods and techniques that can be used to evaluate them, most often in a formative way. They can be regarded as novel ways of mapping pathways through the complex and multilayered world that art and our experience of it offers.

Some of findings from the studies are that:

- the inclusion of interactive art systems within live performance works has an impact on the process of development and structure of these new performances;
- the subjective and bodily nature of experiences made possible only by 'Live Art' poses challenges to conventional art making and exhibiting/performance practices;
- feeling part of a collaborative, creative musical process seems closely related to the sense of control that participants have over their individual contribution;
- audience responses were differentiated in terms of 'analytic' and 'affective' in relation to interactive art experience. This distinction was important to the artist's understanding of the impact of a particular work.

Some of the art forms investigated and practised include:

- dance works that incorporate interactive large-scale projections as partners in the choreography;
- collaborative interactive gaming;
- a digital art exhibition based in presented in an augmented-reality 'layer' overlaid on a well-known art gallery space;
- telematic musical improvisation in small ensembles;
- swarms of robotic systems acting on the wall surface of a gallery space;
- a whole-body interaction game using digital projection undertaken within a truck positioned on a city street during a festival
- interactive digital projection artworks with accompanying retrospective exhibition and curatorial design
- interactive musical systems that may be networked in various ways, or in another case are situated within a museum space and designed for the novice musicians;
- urban-scale light projections or street sculpture works with interactive components;
- distributed art systems in which the elements interact with one another across the Internet.

As described in Chap. 13 ("Evaluation in Public Art: The Light Logic Exhibition by Alarcon", Alarcon-Diaz et al. 2014), there are many layers to the process and the outcomes have benefit for different kinds of stakeholders

> The type of evaluation study described here is one in which evidence about the curatorial, artistic and audience dimensions of a public art exhibition is acquired and then used to establish the value of a particular artefact or experience. This kind of approach to evaluation lends itself to the creation of shared values based on agreed evidence because it involves an exploration of situational knowledge. The gathering of information about what takes place, how audiences respond to the art exhibition and what curators and artists learn from the designing, making and reflecting process contributes to an understanding of what makes a successful or otherwise exhibition of art in the public arena (Chap. 13, Alarcon-Diaz et al. 2014, p. 207).

It is also important to consider the longer-term trajectory of evaluation in practice with respect of much of the work presented in the chapters to follow. In Chap. 2, "Human Computer Interaction, Art and Experience", Edmonds (2014) points to a future in which research has become an integral part of art practice and where formal or semi-formal evaluation studies are incorporated into artists' working lives. This is a future, he suggests, in which creative practices provide a basis for the advancement of research into human interaction with computers. The effect on artists of doing more such research might stimulate attention to the fundamentals of human cognition of the art system but (hopefully) not to replace controversial and unexpected artworks with consumer-led, predictable art. He speculates that better informed artists will be more able to choose to disturb or confuse audiences as well as making art that relaxes and delights them if they so choose. Interaction designers may also have a great deal to gain from venturing into the artist's territory by employing the capability of new forms of technological wizardly to the exploitation of creative impulses. If Edmonds' view of the future is right, a more informed understanding of creative interaction gained from the digital interactive arts, will become more central to HCI research.

The contributors to this book have no doubt that this is indeed the future as their enthusiasm and dedication to transgressing the boundaries of different disciplines in a bid to create new forms of art and novel uses of computing technology indicate all too clearly.

1.4 The Chapters

Ernest Edmonds' chapter reviews knowledge about interactive art from a historical perspective while contextualizing current research interest for interactive artists. Crucially, it poses a series of research questions that position the focus of this volume. Finally, it presents two frameworks for understanding interaction with interactive art that have been drawn from research studies with artwork audiences.

Linda Candy's chapter discusses what evaluation means within the context of interactive digital art and proposes reasons why it is a problem for some artists.

A number of interrelated issues are covered including: developments in HCI that resonate with practice-based research and a view of art as experience as distinct from artefact centred art, drawing upon John Dewey, whose ideas are especially prescient in respect of interactive art and audience participation.

Andrew Johnston's chapter examines the way that practice-based research intersects with evaluation within the context of the creation of a large-scale dance work in collaboration with a physical theatre company. He discusses methods for aligning the goals of researchers and the artists and proposes a set of strategies for practitioners. He distinguishes between "evaluation" that focuses on the artefact and "examination" that keeps site of the broader context of artists' experience in working with interactive art systems.

Scott Simon's chapter adopts a more philosophical approach in which he focuses on the relationship between traditional interpretations of the role of the audience in art, and its changing nature in the new interactive art contexts. He proposes a methodology that provides artists with new incentives to create works without boundaries and, for example, to approach theoretical concepts such as art and beauty as opportunities to work "playfully" within these categories.

Oliver Bown, Petra Gemeinboeck and Rob Saunders discuss interactive art systems that exist as *art behaviours* in robotic or computational forms. They situate their work within the well-established tradition of cybernetic art and discuss the way five specific examples demonstrate various aspects of autonomy, by using classifications of their behaviour with the audience. This work is at the forefront of meaningful discussion on how to assess interactive art systems that are characterized by behaviour rather than appearance.

Lian Loke and George Khut's chapter describes the development, mainly through their artistic practice, of the "facilitated interaction framework". The case studies described provide insight into the way audience experience and critical reflection are combined and facilitated by the artists. The approach introduces a significant departure from familiar notions about formative evaluation in that the strategies for reflection by the audience (including documentation to enable the sharing of experience) are embedded into the artwork itself, with the aim to make experience of the art and its evaluation a co-evolutionary process.

Roger Mills and Kirsty Beilharz' chapter focuses on the evaluation of music-making for musicians. They position 'telematic' music in relation to social semiotics and cognitive linguistics, and develop a framework for evaluating such music making case studies. They introduce an image schema metaphor to structure the way that musicians think about and develop their musical interaction, and then discuss a systematic evaluation case study of a music-making session.

Nick Bryan-Kinns' chapter deals with mutual engagement and collaboration within digital networked music making, discussing the way that novice musicians can mutually engage in micro-creativity. The birth, development and sustenance of these micro-ideas, or memes, as they propagate through the constructed experience

are explored using a series of visualizations that help us to understand the judgments of the participants.

Chek Tien Tan and Sam Ferguson focus on the role of evaluation of emotions in interactive digital art. They review recent research into emotion systems in humans and the use of emotion within the assessment of interactive art. They also discuss the use of a real-time facial emotion recognizer to evaluate the experience of an interactive game, finding that this automated method closely mirrors post-play questionnaire responses.

Derek Reilly, Fanny Chevalier and Dustin Freeman's chapter discusses the integration of research into the evaluation of interaction with interactive art projects. It develops a narrative describing the process of building a public art exhibit and research project in parallel, while discussing the ethical issues that arose during the process of development.

Ben Bengler and Nick Bryan-Kinn's chapter describes a mixed method for evaluating audience interaction with a collaborative interactive music system. The system enables users without musical training to partake in collaborative music making. The approach aims to cater for audience evaluation that takes place in the context of public exhibitions. The interactive music making system is innovative and the evaluation work is unusual in public art events.

Ximena Alarcón-Díaz, Kira Askaroff, Linda Candy, Ernest Edmonds, Jane Faram and Gillian Hobson provide an account of a systematic evaluation study of an exhibition which took place in early 2013. They describe a process that used a variety of methods to evaluate the audience's experience of the exhibition design and artworks (many of which were digital and/or interactive) on display. The meticulous work of a number of gallery staff and researchers resulted in several research findings and surprises that highlight the way in which an artist or curator can use evaluation to gain new perspectives on the presentation of their work.

Stephen Barrass and Ana Sanchez's chapter describes the production of a mobile augmented reality exhibition in the Garden of Australian Dreams at the National Museum of Australia. A new technique applied was the use of online platforms to employ the augmented reality application 'Layar' to guide the evaluation of artefacts digitally placed within the gallery space.

Deborah Turnbull and Matthew Connell's chapter introduces the author's experience of how public digital art is commissioned, curated and evaluated for installation in various contexts within an urban setting. The chapter features three models for the curation of digital public art and discusses challenges that emerge from the process.

Jennifer Sheridan's chapter provides a personal first person narrative of the evolution of a Digital Arts career in business entrepreneurship. Many works and exhibitions, across a period of a decade, are discussed and contextualised within this narrative. This chapter introduces new ways of thinking and working in public art and signals the arrival of a new type of entrepreneur within the digital arts.

References

Alarcon-Diaz X, Askaroff K, Candy L, Edmonds EA, Faram J, Hobson G (2014) Evaluation in public art: the light logic exhibition. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 187–208

Edmonds EA (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23

Gaver W (2012) What should we expect from research through design? In: Konstan J, Chi E, Hook K (eds) Proceedings of the SIGCHI conference on human factors in computing systems (CHI '12). ACM Press, New York, pp 937–946

Chapter 2
Human Computer Interaction, Art and Experience

Ernest A. Edmonds

Abstract This chapter considers relationships between the interactive arts, audience engagement, and experience design in public art. What might each offer the other? Engagement and experience are central to current Human Computer Interaction (HCI) thinking. For artists, what the audience experiences or feels is a key consideration. This chapter presents research issues involved in defining and understanding audience/user engagement and experience. A series of broad questions are posed and discussed. Two examples of approaches being followed to find answers to some of these questions are presented that demonstrate the kind of interesting results that are emerging including a more refined language for describing interactive experience. This research shows how frameworks, that support interactive art making and evaluation are being developed using practice-based research methodologies. These advances, made in the context of art, can be beneficially applied to both the interactive Digital Arts and HCI.

2.1 Introduction

For artists, what the audience feels, the experience, is a key factor. This goes beyond what the piece sounds or looks like. Interactive digital art, in particular, is very much about the interactive experience. It is not surprising, therefore, that the growing body of Practice-Based Research (PBR) (see Candy 2011) in interactive Digital Art is pushing the boundaries of our knowledge about what, in Human-Computer Interaction (HCI), we know as 'experience design'.

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Interdisciplinary research across the relevant parts of science, technology and art can inform us both about artistic and scientific aspects of interaction, making experience design a truly interdisciplinary field. At least, that is one position. The chapter discusses questions relating to this issue and presents some work that might lead to answers.

The questions posed below and in detail in Sect. 2.4, represent a research agenda relating HCI, Digital Art and participant experience. In particular, there are various aspects of experiencing an interactive system that we either do not have answers to yet or only have partial answers: When is it engaging? What makes it engaging? What impact does familiarity have? A question that runs through most of this book is how to find methods that enable the evaluation of interactive experience to take place. As is argued in this chapter, and elsewhere, HCI and interactive Digital Art have much to offer one another, but exactly what can be transferred in each direction?

The work that is reviewed below in the section on Frameworks shows two examples of approaches being followed to find answers to some of these questions. They demonstrate that progress is being made and that very interesting results are emerging. In the case of these particular examples, we see that a more refined language for describing interactive experiences is being developed and that, even by itself, is a valuable step forward. This book contains a wide range of such contributions described by the practitioner researchers that are undertaking both art and technology projects. This chapter ends with some speculative propositions about the future that all of this work might eventually lead to.

2.2 Background

Digital Art is increasingly interactive. Some of it is built on interactions that evolved from computer games and device usage. Much of it is intended to engage the audience in some form of interactive experience that is a key element in the aesthetics of the art. Issues relating to Human-Computer Interaction (HCI) could be considered to be as important to interactive art creation as issues relating to the colours of paint are to painting. Concerns related to experience design, understanding the user, or audience and engagement are especially relevant. This chapter, and this book in general, is not concerned with task analysis, error prevention or task completion times, but with pleasure, play, experience, and short and long-term engagement. In interactive Digital Art, the artist is often concerned with how the artwork behaves, how the audience interacts with it (and possibly with one another through it) and, ultimately, in participant experience and degree of engagement. In one sense, these issues have always been part of the artist's world. In the case of interactive art, they have become both more explicit and more prominent within the full canon of concerns.

Whilst HCI in its various forms can offer results that at times can help the artist, it seems that the concerns in interactive art, rather like those in computer game

design, go beyond traditional HCI. Hence, we focus on certain relevant issues that are emerging in HCI research field, for example the increased emphasis on experience design. As is well known to HCI practitioners, there is no simple cookbook of recipes for interaction and experience design. Rather, there are research and evaluation methods that involve users as part of the design process. The implications of this HCI practice for art practice are, in themselves, interesting. The main implication is that the art-making process needs to accommodate some form of audience research within what has often been a protected and private activity.

2.3 An Art Historical Perspective of Interaction

Even when we stand still and look at Leonardo de Vinci's painting, *Mona Lisa*, our perceptual system is actively engaging with the painting and we could be said to be changing in ourselves as a result of that experience. By contrast, whatever the viewer does, whether standing still or moving, does not change the painting in any way. As we look longer, the painting may *seem* to change and we sometimes say that we "see more in it", but it is our perception of it that is changing. This change process is most often mentioned in relation to works such as the paintings of Mark Rothko, where at first it may seem as if there is nothing much to see, but the more we look the more we perceive in time. Campbell-Johnston commented, "…as you gaze into the [Rothko] canvases you see that their surfaces are modulated. Different patterns and intensities and tones emerge" (Campbell-Johnston 2008). Marcel Duchamp went so far as to claim that the audience completes the artwork, in which case active engagement with the work by the viewer is the final step in the creative process. As Duchamp put it, "the spectator … adds his contribution to the creative act" (Duchamp 1957, p. 140). From this perspective, audience engagement with an artwork is an essential part of the creative process. The audience is seen to join with the artist in making the work complete.

This view of the audience became a particularly significant one in the second half of the twentieth century. For example, Jack Burnham saw the importance of understanding artworks in their environment and that all things "which processes art data, …are components of the work of art" (Burnham 1969). So, by that definition, the audience is part of the artwork. By 1966, Roy Ascott had developed a view in which participation and interaction between the audience and the artwork was central (Ascott 1966). He later gave up the practice of making art objects all together: "In California in the 1970s, introduced to the computer conferencing system of Jacques Vallée, Informedia, I saw at once its potential as a medium for art and in 1979 abandoned painting entirely in order to devote myself wholly and exclusively to exploring telematics as a medium for art" (Ascott 1998). In other art forms, such as Happenings, participation was also prevalent. Kirby described rather basic examples of participation in Allan Kaprow's *Eat*: "Directly in front of the entrance, apples hung on rough strings from the ceiling. If the visitor wished, he could remove one of the apples and eat it or, if he was not very hungry, merely

take a bite from it and leave it dangling" (Kirby 1965). Participation in the artwork, by becoming part of the art system and interacting with whatever the artist provided, was becoming a familiar experience, whether it was typing at the keyboard or eating the apple.

Since the 1960s, an increasing number of artists have been taking active engagement further. Most famously, direct and physical audience participation became an integral part of the artwork and the performance of Happenings (Sandford 1995). Situations were set up by the artists with which the audience was meant to engage by actually taking part and hence explicitly 'create' the work. Thus, the artwork itself was changed by and evolved through the audience. Indeed, the activity of engagement became a part of the artwork. Art was interactive before the use of electronics, integrated circuits, and computing and networking devices.

The interactivity of art has become much more explicit as a result of the many ways in which computing technologies and the Internet have facilitated it. The computer, as a control device, can initiate and manage interactive processes in ways never seen before. Computing devices have become a ubiquitous material in our society. They operate our watches, our washing machines, our telephones, our cars, and a high percentage of the other devices that we use. Artworks that incorporate computing are an extension of the work that artists have been making for years: work that integrates and reflects prominent cultural materials. As a result of these changes new questions are arising and some old questions are being looked at again from a new perspective. The next section reviews such questions and introduces a discussion about the ways in which they can be tackled.

2.4 Questions to Address

What are the relationships between interactive art, audience engagement, and experience design and what might each offer the other? We can break this primary question down into the following:

When is experiencing interaction engaging?

What factors influence engagement with interaction? Which modalities are most significant? If we combine sound and image, for example, is engagement increased? Can we predict engagement? What kind of engagement is interesting and valuable? Is engagement with art of any relevance to engagement with, for example, an information system?

The central point is to see if we can discover how to predict engagement with interaction in these various respects. First, however, we need to know if there *is* any engagement in any particular situation. Certain clues can be obtained by simple observation. For example, if after a quick look someone walks away and goes to do something else we might assume that they were not very engaged. On the other hand, if they keep coming back to a work and actively interact with it over long periods of time, we might assume that they were engaged. These simple measures

are helpful but to understand the factors better we need to use methods that elicit the information from participants by either having them verbalise their experiences or by asking them in interviews.

How can we evaluate the experience of interaction?

How do we get at the experience that our users/audiences experience? Can we ask them to articulate their feelings during the experience? Must we rely on recall? Are there any objective measures?

Following on from our first question, there is a need to identify and develop methods for conducting evaluation. In the HCI world, closely related questions are seen to be important and both practitioners and researchers are trying to find answers, as for example in a CHI conference workshop (Väänänen-Vainio-Mattila et al. 2008). The questions are the subject of Chap. 3 ("Evaluation and Experience in Art", Candy 2014), which discusses both the nature of evaluation in this context and approaches to conducting principled studies. The chapters of the book make a different contributions to the questions about methods for creation and evaluation and, taken as a whole, the book provides 'answers' as far as we are able to give at this point in time.

How do familiarity and engagement inter-relate?

If we are familiar with something, is our engagement likely to be lower? If the experience is subtle, might our engagement actually increase with familiarity?

The crucial point is that both levels and the quality of engagement will change as time goes on. For almost every question that we ask we can expect to find that the answer evolves, or even changes dramatically, over time. Changes may occur whilst a participant is interacting, between sessions or over months or years of familiarity. For example, initial delight and excitement in a simple, well designed, interaction piece may well turn to boredom after 10, 20, 30 or 100 repeats. The participant might come to yearn for the system to do something different. Of-course, some artworks do change their behaviour over time but then a change in behaviour implies at least the possibility of a change in the level of engagement. Zafer Bilda's work which is briefly discussed later in this chapter, makes a contribution to the answer to this question in the sense of showing how, in any particular case, we might tackle it (Bilda et al. 2008; Bilda 2011).

Where is the art: in the object or in the experience?

Is interactive art about artworks? Perhaps it is only concerned with audience experience and not with objects at all? Might HCI design be less related to graphic or industrial design than we thought: less concerned with the object and more with the experience?

In one respect this is a philosophical rather than an empirical question. It asks where the essence of an interactive artwork is to be found. We might compare it to a question about a poem. Is the poem embodied in this particular text on this particular piece of paper? We might argue that the poem is some abstract thing that finds embodiment on the page. That is not good enough in the case of the

interactive artwork, however. Somehow the participant's behaviour and experience is central to the essence of the work. So this is a hard question. Rather than try to answer it we might simply note that we need to consider what we can discover about participant experience with at least as much vigour as we consider aspects of the object – interactive artwork, information system or whatever it might be.

Whose experience: audience or performer?

Sometimes, we might look at an expert user or, in art terms, an expert performer interacting. A performance piece can be interactive. It is just that the direct participants are not members of the audience but professional performers, such as musicians.

Umberto Eco distinguished between a performer and a member of the audience, "an interpreter", but argues that in the context of what he terms an 'open work', they are in much the same situation (Eco 1989). Looking at, listening to, or interacting with an artwork is a performance in his terms. The way that we might tackle our studies need not vary much between cases where the interactive experience belongs to the audience and ones where it belongs to the performer. Andrew Johnston, for example, has worked on performer experience as part of his research and creative practice in both music and dance. See Chap. 4 ("Keeping Research in Tune with Practice", Johnston 2014) in this book for more details of that work.

What makes interactive art engaging?

When and if an interactive work is engaging, why is it so? It is probably not simply because it sounds or looks nice. It is likely to be about the interactive relationship itself. So what are the characteristics of interactive relationships that engage us?

In evaluating interactive art and trying to find when and if it is engaging, we clearly need to make comparisons and try to isolate the influential factors. Laboratory style controlled experiments are hard or impossible to conduct in this area because the complexity of the problem. There are many variables and we do not have direct access to the human experiences that are a central concern. However, we need to find some way of drawing comparisons between different design features and participant experiences. So we need to conduct research that does so and, even if it cannot be as reliable as we might wish, find ways of forming confident opinions. For example, we might use collective expert opinion as a mechanism that can lead to results that we trust; and it will be noted that a number of authors in this book do exactly that.

Can HCI teach art anything?

What can art learn from HCI? Can interactive artists make better art through engaging with HCI? On the other hand, does HCI make their art boring, less intuitive and authentic? Which artists benefit: 'professional', gallery artists or artist-researchers creating prototypes?

A key current HCI issue is the problem of supporting people to be more creative. The implied research required is about understanding creative processes. This includes

the contexts in which they flourish and the constraints that help or hinder successful results. Hidden behind this research is a requirement to evaluate creative processes and, hence, a need to determine the success or failure of their outcomes. Taken as a whole, we can see that this is a particularly difficult research challenge. So, how can art help? Well, it is common in science to look at what are known as 'boundary conditions' or 'boundary cases'. We can often learn most by studying the more extreme conditions than we can by studying just the normal everyday ones. For example, vision research, or how we see and understand the world around us, is quite a difficult topic. One way in which it has been advanced is by looking at when the process goes wrong. For example, by studying visual illusions, where we can find clues about how the process works or looking how failures actually stimulate creativity (Fischer 1994).

These questions have been a significant part of the ACM SIGCHI Creativity and Cognition conference series (e.g. Creativity and Cognition 2013) and, more recently have become an area that the CHI conferences have paid explicit attention to, although the research community is still in the early stages of exploiting the opportunities that the question implies.

Can art teach HCI anything?

Is interactive art a potential source of new insights about user experience and how to shape it? Or is interactive art a task-free world of no practical interest to CHI? Do we need to be clearer about the artistic contexts within which we are working if we are to learn anything?

Much of the knowledge of HCI and, perhaps more significantly, its methods can contribute to interactive art making. From HCI, we know how easy it is for a designer to shape software in ways that seem easy to use to them but that are a mystery to others. It is normally seen as an issue of distinguishing between the model of the system held by the various players: programmer, designer and user (Norman 1988). Such confusion often happens when the designer makes an unconscious assumption that is not shared by others. For example, when an item is dragged over and 'dropped' on a waste-bin or trash icon, it will normally be made ready to be deleted but retained for the moment. People new to computers sometimes assume that it is lost forever and so are nervous about using it, leading to behaviours unexpected by the designer. The same kind of thing can happen with interactive art. The artist may or may not mind but they do need to be aware of such issues and make conscious decisions about them.

At least in part, as a result of the HCI activities mentioned in relation to the previous question, we are seeing interesting examples of new ideas in HCI that come from observations about art. A recent example of work of this kind is Benford's discussion of user interfaces that make people uncomfortable. He shows that we can learn from art that making the user comfortable is not the only option and may not always be the best one (Benford et al. 2013). This article can be seen as an example of the application of Costello's approach as described in Sect. 2.5.1. Her work is interesting in the cyclic way in which she draws on HCI and psychology to make art and then gains insights that in turn, can contribute to HCI. This kind of work is

described in the next section, in which two example frameworks that begin to answer some of the questions posed above, are discussed.

2.5 Frameworks for Interactive Art

Considering the questions in the last section and, in particular, the last two issues, two significant specific contributions are now reviewed, each of which adds to our ability to deal with the issues and questions discussed above.

2.5.1 Costello's Pleasure Framework

In the context of making interactive art, Brigid Costello has argued that the nature of play can best be understood using a taxonomy that she has termed a "pleasure framework" (Costello 2007, 2011; Costello and Edmonds 2010). This work was done in the context of making artworks, such as *Just a Bit of Spin* (Fig. 2.1), in which participants enter into a game like situation playing with excerpts from Australian political speeches.

In doing this work Costello has synthesized a collection of research results that relate pleasure to 13 categories, each of which has quite different characteristics:

Creation is the pleasure participants get from having the power to create something while interacting with a work. It is also the pleasure participants get from being able to express themselves creatively.

Exploration is the pleasure participants get from exploring a situation. Exploration is often linked with the next pleasure, discovery, but not always. Sometimes it is fun to just explore.

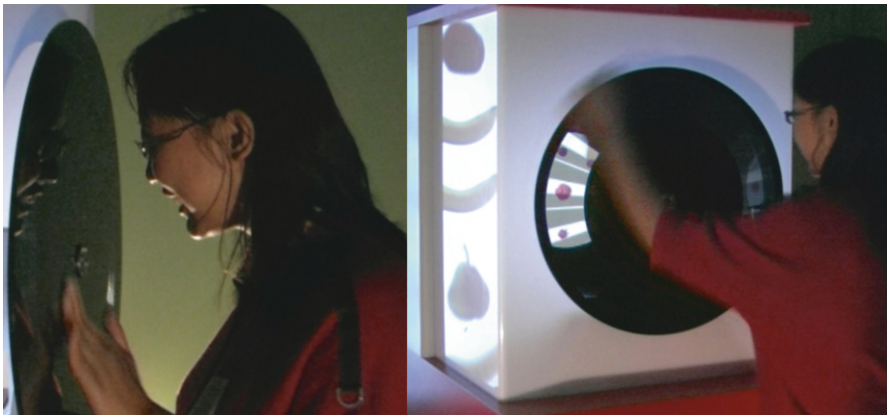

Fig. 2.1 Two views of someone interacting with *Just a Bit of Spin* (Photographs Brigid Costello 2007, reproduced with kind permission)

Discovery is the pleasure participants get from making a discovery or working something out.
Difficulty is the pleasure participants get from having to develop a skill or to exercise skill in order to do something. Difficulty might also occur at an intellectual level in works that require a certain amount of skill to understand them or an aspect of their content.
Competition is the pleasure participants get from trying to achieve a defined goal. This could be a goal that is defined by them or it might be one that is defined by the work. Completing the goal could involve working with or against another human participant, a perceived entity within the work, or the system of the work itself.
Danger is the pleasure of participants feeling scared, in danger, or as if they are taking a risk. This feeling might be as mild as a sense of unease or might involve a strong feeling of fear.
*Captivatio*n is the pleasure of participants feeling mesmerized or spellbound by something or of feeling like another entity has control over them.
Sensation is the pleasure participants get from the feeling of any physical action the work evokes, e.g. touch, body movements, hearing, vocalizing etc.
Sympathy is the pleasure of sharing emotional or physical feelings with something.
Simulation is the pleasure of perceiving a copy or representation of something from real life.
Fantasy is the pleasure of perceiving a fantastical creation of the imagination.
Camaraderie is the pleasure of developing a sense of friendship, fellowship or intimacy with someone.
Subversion is the pleasure of breaking rules or of seeing others break them. It is also the pleasure of subverting or twisting the meaning of something or of seeing someone else do so.

Even a very brief look at the categories that Costello has identified shows that playful interaction comes in many forms and so the characteristics of a playful artworks may be quite different to one another when then evoke or encourage different kinds of playful engagement. Whether we look at this issue from the point of view of an artist making a playful work or of an interaction designer incorporating play into an interactive system, we can see that the questions that need to be addressed in more detail than indicated in the previous section. From Costello's work we also begin to see some of the answers.

It turns out that the time spent with a system and its familiarity changes the nature of the experience in various ways, whether we are concerned with playfulness or not. This is the focus of the second framework to be discussed.

2.5.2 Bilda's Engagement Framework

Zafer Bilda has developed a model of the engagement process through studies of audience interactions with a range of artworks (Bilda et al. 2008; Bilda 2011). He found that the engagement mode shifts from unintended actions through to deliberate ones that can lead further to a sense of control. In some works, it continues into modes that engage more exploration and uncertainty. He has identified four interaction phases; adaptation, learning, anticipation, and deeper understanding (Fig. 2.2).

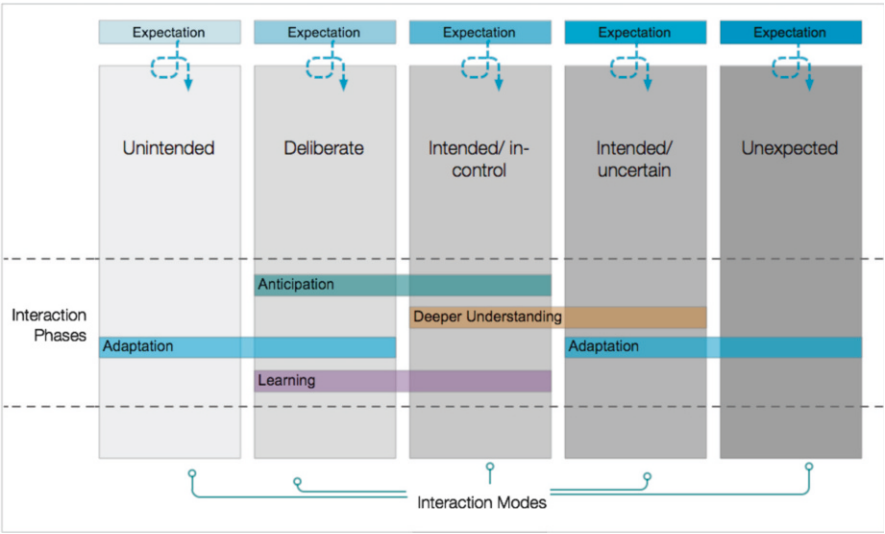

Fig. 2.2 Bilda's creative engagement model (Reproduced with kind permission)

Adaptation: Participants adapt to the changes in the environment, learning how to behave and how to set expectations. They work with and through uncertainty. This phase often develops from unintended action mode through to deliberate action mode.

Learning: Participants begin to develop an internal or mental model of what the system does. This also means that they develop (and change) expectations, emotions, and behaviours, as well as access internal memories and beliefs. In this phase, the participant interprets exchanges with the system and explores and experiments with relationships between initiation and feedback from the system. They develop expectations about how to initiate certain feedback and accumulate interpretations of the exchanges. This phase can occur from deliberate action mode to intended/in-control mode.

Anticipation: In this phase, participants know what the system will do in relation to initiation. In other words they can predict the interaction. Their intention is more grounded as compared to the previously described phases. This phase can occur from deliberate action mode to intended/in control mode.

Deeper understanding: Participants reach a more complete understanding of the artwork and what his or her relationship is to the artwork. In this phase participants judge and evaluate at a higher, conceptual level. Thus, they may discover a new aspect of an artwork or an exchange not noticed before. This phase can occur from intended/in control mode to intended/uncertain mode.

There are forms of engagement that may or may not be desired in relation to an artwork. For example, in museum studies people talk about attractors, attributes of an exhibit that encourage the public to pay attention and so become engaged.

They have "attraction power" using Bollo and Dal Pozzolo's term (Bollo and Dal Pozzolo 2005). In a busy public place, be it museum or bar, there are many distractions and points of interest. The attractor is some feature of the interactive art system that is inclined to cause passers by to pay attention to the work, approach it, and look or listen for a few moments. An immediate question arises of how long such engagement might last. Counter-intuitively, we find that the attributes that encourage sustained engagement are not the same as those that attract. Sustainers have holding power and create "hot spots", in Bollo and Dal Pozzolo's term. So, presuming that the attractors have gained attention, it becomes necessary to begin engaging the audience in a way that can sustain interest for a significant period of time. This aspect of engagement might be found in the learning phase of Bilda's model.

Another form of engagement is one that extends over long periods of time, where the visitor returns for repeated experiences, as in seeing a favourite play as many performances throughout one's life. These are factors that enable the hot spot to remain hot on repeated visits to the exhibition. Facilitating this meets with the highest approval in museum and gallery world. This aspect of engagement might be found in the deeper understanding phase of Bilda's model. We often find that this long-term form of engagement is not associated with a strong initial attraction. Engagement can evolve with experience. These issues, once recognized, are important to the interactive artist, and such conscious choices have significant influence on the nature of the interaction employed.

2.6 Conclusion: What Next?

The questions posed above are large ones without easy answers. However the frameworks briefly reviewed show that progress towards answering them is under way. The next chapter discusses evaluation, in this context and in depth and all of the questions raised above are tackled in various directions and combinations in other chapters of the book. The contention is that the relationships between the interactive arts, audience engagement, and experience design in public art form an important and fertile research landscape, the study of which can be highly beneficial to both the interactive Digital Arts and HCI. For other examples of such work and more detailed discussion see the book on interactive art research (Candy and Edmonds 2011), which might be seen as a companion volume to this text. This chapter, this book and much of the other work referenced point to a future in which research is often an integral part of art practice and where formal or semi-formal evaluation studies are incorporated into artists' working lives. Equally, they point to a future in which creative practices provide a significant basis for the advancement of human computer interaction. So what might these futures look like?

From the artist's point of view, we can expect a growth in the informed attention to the human participant's perception and cognition of the art system and its context. This will in no way imply that artworks will increasingly be made to please or to match consumer demand. On the contrary, it implies that the artist will be more able

to challenge perception and cognition, to disturb, alarm or confuse participants should they want to as well as to relax, indulge or mesmerise them if that is their choice. From the interaction designer's perspective we surely will see a growth in the interest in encouraging, even exploiting, creative behaviour in users. The exploiting may come in the form of increasing engagement and interest through the provision of more creative experiences. In this view of the future, the encouragement of creativity in users, informed by a better understanding of creative interaction from the arts, will most probably take the centre stage in HCI. Already the days of task oriented HCI seem to be in the past and realisation of the future proposed here is well underway.

The application of the evaluation methods discussed in this book in interactive art is likely, then, to lead to a stronger emphasis in the arts on perception and cognition in interactive situations. In turn, the new knowledge that can come from such work will most probably accelerate the moves in HCI towards making support for human creativity the central theme.

References

Ascott R (1966) Behaviourist art and the cybernetic vision. Cybernetica 9:247–264

Ascott R (1998) The technoetic dimension of art. In: Sommerer C, Mignonneau L (eds) Art@ Science. Springer, Wien/New York, pp 279–290

Benford B, Greenhalgh C, Giannachi G, Walker B, Marshall J, Rodden T (2013) Uncomfortable user experience. Commun ACM 56(9):66–73

Bilda Z (2011) Designing for audience engagement. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing, Oxfordshire. 1631181

Bilda Z, Edmonds E, Candy L (2008) Designing for creative engagement. Des Stud 29(6):525–540

Bollo A, Dal Pozzolo L (2005) Analysis of visitor behaviour inside the museum: an empirical study. In: Proceedings of the 8th international conference on arts and cultural management, Montreal, July

Burnham J (1969) Real time systems. Artforum 8:49–55

Campbell-Johnston R (2008) Mark Rothko at Tate Modern. The Times, London. September 24, 2008. http://entertainment.timesonline.co.uk/tol/arts_and_entertainment/visual_arts/article4811134.ece. Accessed 1 May 2010

Candy L (2011) Research and creative practice. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing, Faringdon, pp 33–59

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

Candy L, Edmonds EA (eds) (2011) Interacting: art, research and the creative practitioner. Libri Publishing, Oxfordshire

Costello BM (2007) A pleasure framework. Leonardo 40(4):370–371

Costello BM (2011) Many voices, one project. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing, Oxfordshire, pp 182–194

Costello BM, Edmonds EA (2010) A tool for characterizing the experience of play. In: Proceedings of the sixth Australasian conference on interactive entertainment. ACM Press, New York. http://dl.acm.org/citation.cfm?id=1746052&CFID=383605423&CFTOKEN=60569673

Creativity and Cognition (2013) Proceedings of the 9th ACM conference on Creativity & Cognition. ACM Press, New York, pp 1–10

Duchamp M (1957) “The creative act” Talk given in 1957 reprinted in Sanouillet M, Peterson E (eds) (1975) The essential writings of Marcel Duchamp. Thames and Hudson, London, pp 138–140

Eco U (1989) The open work. Harvard University Press, Cambridge, MA. First published in 1962 as *Opera Aperta*

Fischer G (1994) Turning breakdowns into opportunities for creativity. Knowl Based Syst 7(4):221–232

Johnston A (2014) Keeping research in tune with practice. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 49–62

Kirby M (1965) Alan Kaprow’s eat. Tulane Drama Rev 10(2):44–49

Norman D (1988) The design of everyday things. Doubleday, New York

Sandford M (1995) Happenings and other acts, Worlds of performance. Routledge, New York

Väänänen-Vainio-Mattila K, Roto V, Hassenzahl M (2008) Now let’s do it in practice: user experience evaluation methods in product development. In: Proceedings of the CHI EA ’08. ACM Press, New York, pp 3961–3964

Chapter 3
Evaluation and Experience in Art

Linda Candy

Abstract This chapter is about evaluation in the creation and experience of interactive art and its implications for practitioner research methodologies. Central to the need for evaluation is the transformative nature of experience in art and the way that the advent of interactivity in the digital age has changed the audience from viewer to a new kind of participant. This has given rise to opportunities for exploring interactive experience in a creative context, one that has been recognised by researchers and art practitioners alike. Although evaluation in the service of art practice is an unfamiliar notion to many, there is no doubt that in respect of evaluation and art experience, the boundaries of what is possible are being extended in interactive art development. In Practice Based Research and Human Computer Interaction new opportunities are arising that bridge the interests of digital art and interaction design. A framework for evaluating interactive art development and experience is presented followed by discussion of the approaches and methods represented in the following chapters of the book. These approaches illustrate the diversity to be found in interactive arts evaluation processes, from documented reflective practice to evidence based methods.

3.1 Introduction

This chapter is about evaluation in the creation and experience of interactive art and its implications for practitioner research methodologies. Although evaluation in the service of art practice is an unfamiliar notion to many, practitioner researchers are giving it a new role that can have an immediate impact on the way art is made and exhibited. Central to such evaluation is the way that interactivity in digital art has

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transformed the nature of audience experience. This has given rise to opportunities for exploring interactive experience in a creative context and new forms of research led by artists are introducing evaluation into art practice. Novel approaches that represent the multiple dimensions of this form of evaluation in which documented reflective practice and evidence from observational studies are transforming the methodological repertoire available to practitioners. These initiatives are by no means accepted in the wider arts world and there is no sense as yet that the field has established settled methodologies as later discussions make clear, but there is no doubt that in respect of evaluation and art experience, the boundaries of what is possible are being extended by interactive art development.

The chapter begins with a short discussion of developments in Human Computer Interaction (HCI) that resonate with Practice-Based Research (PBR) in the interactive digital arts. It then moves to discuss the nature of evaluation in interactive arts experience informed by methods drawn from HCI, ethnography and social science. That the place of evaluation in art remains problematic is nevertheless acknowledged and that issue is explored through a discussion of negative connotations and misapprehensions that have to an extent, obscured the potential benefits of practitioner-generated insights. The evaluation of interactive art experience based upon evidence from research is not an area where there are settled methodologies. However, the appropriation and customisation of approaches such as reflective practice and ethnographic research is strengthening practitioners' ability to voice their own appraisals. The chapter goes on to propose a view of art as experience drawing upon John Dewey, whose ideas are especially prescient in respect of interactive art and audience participation. The final section presents a general framework as a basis for defining the elements of an evaluative process, followed by discussion of the approaches and methods represented in the following chapters of the book. Example scenarios include: evaluation with audiences in public settings; methods for eliciting audience responses to interactive art experience; the role of reflective practice in formative evaluation and evaluating audience participation strategies.

3.1.1 Evaluation, HCI and Interactive Arts Practice and Research

Evaluation methodologies are well established in the field of Human-Computer Interaction (HCI). The approaches to evaluating interactive systems represented throughout the following chapters of this book are indebted to HCI for practical methods and techniques. In past HCI, 'interaction' was concerned primarily with designing desktop interfaces, which were evaluated by measuring usability, task efficiency and effectiveness (Sweeney et al. 1993; Harker 1995). Later ethnographic and qualitative methodologies were adopted in order to explore the suitability of human centred interaction technologies for more open-ended scenarios (Preece et al. 2002; Crabtree 2003). From the 1990s, opportunities had arisen for more innovative forms of user experience design by collaboration between technologists and artists

(Harris 1999; Candy and Edmonds 2002). Other trends in HCI research began to focus on fun, pleasure, goodness and beauty as experiential goals (Jordan 2000; Tractinsky et al. 2000; Hassenzahl 2004). These moves towards evaluation frameworks that involved non-predictive, open-ended activities operating in situated scenarios and subject to behavioural rather than performance measures have been ongoing for some time but it took time for them to be made more visible to the mainstream community. Saul Greenberg and Bill Buxton summarized these limitations (Greenberg and Buxton 2008) and Gilbert Cockton argued that usability should be replaced by a 'value-based' approach (Cockton 2008).

There are a number of potential synergies between HCI and the Digital Arts both in terms of the development of technological systems and the key aspect of user or participant experience. Many of the preoccupations of interaction designers are similar to those of visual and sonic artists and it is evident that the labels are readily transferable as people operate across these different worlds without even noticing. Of course, the goals and intentions may be quite different but the methods and tools are often similar. Likewise with regard to evaluation: how to design a successful system that meets criteria for playful interaction and where the users/participants are the general public, is as much an HCI question as it is a digital arts one. In the interactive digital arts as a whole, research is proving essential for practitioners to be able to meet the challenges of a complex and difficult form. Those artists are seeking ways forward in practice-based research in which the creation of artefacts plays a key role and evidence-based approaches to audience evaluation contributes to understanding interaction and engagement. A further discussion of the methodology of PBR in interactive arts is to be found in Edmonds and Candy (2010) and Candy (2011).

Because the interactive digital arts are of necessity inter-disciplinary, there is an in-built opportunity to look more widely for ways of working in other disciplines and this leads to great flexibility when it comes to adopting existing methodologies, hence the role of HCI in interactive arts development. As Graham and Cook point out, because doing new media art demands crossing "boundaries between technical and behavioural knowledge", its practitioners are capable of "translating across these barriers" (Graham and Cook 2010, p. 184). However, the translation process requires more than a passing acquaintance with the methods of both fields. Whilst art making for audience experience using high-end technological capability means that interactive artists are well placed to explore and develop new knowledge on the behavioural and technical front, this does not happen without considerable effort to identify and learn methods that will work for a particular practitioner context. How to find out what matters in terms of the way an interactive art system functions usually requires more than intermittent, casual observation. The artist may also be searching for deeper insights into the nature of audience experience that can only be achieved by studying the interactive experiences at length. This requires learning previously unfamiliar methods for acquiring significant amounts of information about audience behaviour and analysing the significance of what has been achieved. This is where the role of evaluation within the context of practice-based research comes into play. The next section considers the different meanings of evaluation as applied in the formative and summative processes of making and experiencing art.

3.1.2 What Do We Mean by Evaluation in Art Experience?

Evaluation in common usage involves judging the value or worth of something usually against measures understood within the particular situation or context. The word is used widely in many fields from the arts, sciences, health, to management, business and education. It covers a range of possible processes that involve establishing the value or worth of an artefact, an event or situation or indeed, a person: for example: judging whether or not someone is suitable for an art commission using criteria based on track records or written proposals. Another form of evaluation in common use is assessing the performance of a product (mechanical, design etc.) by assigning a grade or score. Evaluation can include a comparison of effects against goals and strategies by examining original objectives and assessing what was accomplished for example in the appraisal of organizational procedures against competing schemes. Schools are continually evaluating the progress of their students by way of performance measures and standardised tests as well as by less formal methods such written essays and oral competency tests.

The purpose of evaluation is to be able to understand an existing situation with a view to making progress in the future. Many forms of evaluation may be carried out using various methods with differing degrees of structure and systematisation. The evaluation exercise and its outcomes are intended to be understood within a given context but preferably provide insight that can be understood more widely. There are numerous dimensions and methods that are applied in evaluation and there is no agreed single methodology that everyone adheres to. Hence, the importance of defining the context and application of any evaluation exercise that is undertaken.

Evaluation is universally recognised to have a *formative* role, taking place during the lifetime of a project, with the intention of improving the strategies, functions and outcomes. In a certain sense, it is a form of action research where some new insights are injected into a scenario and the effects of that intervention are observed and acted upon. It can also be a *summative* process, drawing lessons from a completed project that can be compared with other similar types.

The systematic nature of the evaluative process depends largely upon the domain context: in the physical sciences, it is conducted with experimental methods using standard measures whereas in product development it is more likely to be based on designer expertise; the idea of designing an innovative product by evaluating customer satisfaction is unlikely to be an acceptable approach given that the measures could only be applied to existing products. In other words there is a huge difference between evaluation for descriptive purposes of existing phenomena and evaluation for creation (prediction). It is perhaps more appropriate in the creative context, to think in terms of *principled* evaluation in the second as distinct from *systematic* evaluation.

Whatever the domain, evaluation is always tailored to the approach, needs, purpose and methodology of that context. To evaluate successfully may necessitate the systematic collection and analysis of data needed to make decisions. On the other hand, expert judgment can often be exercised without recourse to such studies

because it is founded upon many years of experiential know-how. This factor of applying judgment is in itself incredibly difficult to reduce to simple principles, given the vast array of approaches and criteria that are likely to be applied even in everyday circumstances. Taking the evidence-based route is an attractive pathway towards reducing the range of available judgments. If the word 'systematic' connotes standardisation to some people then using principled is better.

The context of evaluation in this chapter is the development and experience of interactive art. The evaluation of interactive art experience based upon evidence from research is not an area where there are settled methodologies that everyone has agreed and applied routinely. Here, evaluation may involve assessing the worth of a particular artefact or person in relation to comparable works and people. This 'summative' evaluation takes place once everything has been completed and exhibited in public spaces and time is taken to experience and assess it. Over a longer time frame, this form of evaluation accords with Boden's 'H' creative definition (Boden 1990) where sufficient historical time has elapsed for an assessment of worth to be possible in a social context. Evaluation can also have a more contemporary application for example, in judging whether or not a person has an appropriate track record to be worthy of a commission or grant. This form of evaluation takes place every time someone applies for a funding grant or commission.

Practice-based Research is the broad framework within which the approaches to evaluation presented in this chapter and more widely throughout the book, sit. In a PBR trajectory, there are three elements: practice, theory and evaluation. Each element involves activities undertaken by the practitioner in the process of making artefacts, developing conceptual frameworks and performing evaluation studies (Candy and Edmonds 2010). Evaluation that informs practice facilitates reflections on practice and a broader understanding of audience experience of artworks. It usually involves direct observation, monitoring, recording, analysing and reflection as part of a semi- formal approach to generating understandings that go further than informal reflections on personal practice. Whilst the methodology is less prescriptive than that of traditional experimental science, PBR studies are usually carried out using a variety of methods drawn from different disciplines including HCI, ethnography and social science. This kind of evaluation is used to shape the creation of an artefact or product during the process of its development: for example, deciding whether or not to adopt certain materials or assessing the coherence of a composition through visual appraisal or creating a full size mock up of a work in order to understand the effect of the scale on the relationship between objects. Evaluation in this sense, from the artist's perspective, is a way of thinking about what has happened during the making process that can help with detailed decision-making and shape ways of developing or improving the work by revealing what happens as a result of changes. In that sense, the evaluation is '*formative*' to the creation of the works and subject to the artist's personal assessment criteria. Formative evaluation is 'internal' to the creative process because it is part of the making process, whilst summative evaluation is 'external' to that process, in the sense that the artwork or artefact is already finished and ready for an end on assessment. However, this kind of simple distinction between evaluation in terms of the point at which it takes place and the role it plays,

is one that has limitations when it comes to new forms of digital art, as will be discussed later on. Overall, the evaluation that gives voice to the artist when it comes to judging art is an issue that is often ignored or seen as too subjective to be interesting to theoretical and historical discourse.

The advent of interactivity in the digital age has changed the audience from viewer to a new kind of participant which has given rise to opportunities for exploring interactive experience in a creative context, one that has been recognised by HCI researchers and art practitioners alike. However, it must be acknowledged that although change is taking through practitioner led research in the interactive arts, the place of evaluation in art remains problematic for many artists.

3.1.3 The Trouble with Evaluation

In discussions over many years, I have often found that some artists are suspicious of the idea of *evaluation* and the possibility of introducing it into their practice. What kinds of assumptions are made about evaluation when it comes to art? These are some of the things I have been hearing from practitioners as I go about my research:

- Evaluation is necessary but it is a lot of trouble for little reward.
  I know what I like and I don't need any kind of formal evaluation because it takes my focus away from the creative work. If I stop to evaluate all the time, I won't have enough energy for the real thing. Anyway, evaluation is up to other people not me. I'm just the artist.
- Evaluation is a political thing.
  Funding bodies require it because they have to account for spending to their boards. Governments look to justify arts funding from the public purse on the basis of how much they contribute to the economy. Any agency that tries to impose its own assessment criteria will constrain and thereby endanger artistic freedom.
- Evaluation is all about measuring things.
  There are some things you just can't measure in a quantitative way (like art). If you try to measure something you can only measure that which can be measured, such as how much revenue was generated from that project or how many people saw it. And that is hardly the point of art. It just reduces everything to numbers.

As the assumptions above indicate there are different reasons for the unease about evaluation. If truth be known, however, artists are often engaged in a process of evaluating their work, both during its making and after completion- they may just prefer to do it privately and they certainly don't call it by that name. Resistance to evaluation comes at a time when there is increasing demand for accountability from funding bodies and governments and it has become a requirement from grant holders (Arts Council 2013; IXIA 2013). This suggests it is time to go a little further and ask why evaluation, in the context of art practice, is seen as a problem?

First, there is a perception that spending time doing evaluation exercises is extremely time-consuming and it is not really clear what the return for the effort is. In addition, a belief that evaluation conflicts with creativity is widely held: this is something to do with having to adopt different mindsets for making and evaluating, the first being more instinctive, perhaps, the second being more analytic by contrast. A more potent reason for negative perceptions is that evaluation is considered to be dangerous ground because it can act as the thin end of a wedge where the arts will be made to serve external purposes and be subject to different political agendas.

There is also a widely held assumption that evaluation means measurement and that measurement of art is difficult to do without distorting its real value. More broadly, it is fair to say that for many, the word 'evaluation' has direct associations with commercial valuation of art whilst for others, it suggests something systematic, even scientific, and probably out of tune with the ineffable qualities of the creation and experience of art. Recognising the problem of the connotations of the word itself, Andrew Johnston proposes using the word "examination" in order to keep a focus on the broader context of the system use in mind:

> ..we are careful to ensure that as well as evaluating the systems, we more broadly examine the full context of use. The term 'examine' here is deliberately chosen to indicate our intention to look beyond whether or not the system has met the design criteria we established, and instead see the system as a kind of 'probe' which may disrupt performers' habits" (Chap. 4 ("Keeping Research in Tune with Practice")), Johnston (2014).

The problem he identifies is especially prevalent where the focus of evaluation is on the qualities and features of the system itself rather than experience of its use.

The subjective nature of our experience and appreciation of art is also sometimes used to argue that art evaluation is misconceived. This argument rests heavily on the notion that an individual's experience of the artwork is essentially unknowable, and similarly, that an artist's intention or purpose cannot be dissected. Similar objections are made in the face of efforts to understand and describe the nature of creativity. This has not deflected researchers into creativity and much progress has been made (e.g. Sternberg 1999).

It is important to acknowledge the resistance to evaluation but, nevertheless, the argument that art and the experience of art are too complex to be investigated in a systematic manner is opposed by an emerging counterview that research in art (and by practitioners) is not only possible but also necessary. Research brings new knowledge and that knowledge is an important contribution to evaluation based on shared understanding rather than individual instinct. It also has the added value of making practitioners' voices more audible as discussed in Sect. 3.1.4 to follow. The writings of critical theorists and art historians who in their different ways, try to assess the impact of artworks and their place in cultural and societal norms, are in essence, evaluative. For art practitioners, evaluation by critics and historians is a part of the landscape that can be drawn upon when needed, but unless it directly affects them (say through good or bad reviews), it may be largely ignored. On the other hand, there is a growing awareness that it is not good enough to leave the discourse arena entirely occupied by theoreticians looking from outside into practice.

As Sullivan says, "this makes it easier for artists to pass on the job of defining and defending what they do to critics, aestheticians and historians" (Sullivan 2010, p. 85).

3.1.4 The Artist's Voice

People have been evaluating art and its many manifestations from an external perspective throughout the history of documented work. These include art historians, critics, journalists, commentators and the public at large who, whilst they may have different viewpoints and make judgments based on varying levels of expertise, have in common their status as people largely outside the creative process and not in any way directly responsible for the production of the artwork itself. Art criticism in particular, has established its own norms and critical language that dominate the discourse about works created by others. Traditionally, artists are expected to concentrate on making artworks and to leave the interpretation of what they achieve to others. This can lead to a situation where the artist's voice is not heard above the hue and cry of professional critical commentary.

Katharine Kuh, in 'The Artist's Voice' first published in 1962, draws attention to the contrast between how critics see art and what artists intend. For example, critics have labelled Edward Hopper's paintings as being related to loneliness and nostalgia but his own view is:

> If they are it isn't at all conscious. I probably am a lonely one. As for nostalgia, that isn't conscious either. People find something in your work, put it into words and it goes on forever. I have no conscious themes. (Kuh 1962, p. 5).

What he is saying is that it was not his intention to make works that reflect themes such as nostalgia or loneliness. Moreover, as he indicates, such interpretation establishes an ongoing account that is perpetuated forever. It could be said that if Hopper's artworks, are judged to be conveying themes about loneliness and nostalgia, that this is a form of evaluation that resides in the minds of the viewer and does not necessarily arise from the conscious intentions of the artist. It also influences the response of others to an artist's work by framing the discourse in terms of particular themes. In the same set of interviews, Alexander Calder denies the commonly held view that his sculpture was heavily influenced by the advent of new forms of mechanization, asserting that nature was his chief impetus for creation (Kuh 1962).

A great deal has changed since the days when artists were expected to make works and restrict their opinions to the writing of personal manifestos or accounts of the techniques and tools of their trade. Today, with the advent of theoretical inroads into art practice brought about by changes in academic requirements and organisational structures, artists are to be found engaged in critical discourses that may or may not have some direct relationship to the art they create. The practice-based research that has emerged over many years is also giving a stronger voice to the artist. Nowhere is this more evident than in the interactive digital arts (Sommerer and Mignonneau 2009; Graham and Cook 2010; Candy and Edmonds 2011).

Evaluation that takes place during art making is an integral part of the process. Artists have their own personal and highly individualised forms of assessment that is usually implicit. When referring to formative and summative evaluation previously, I made a distinction between 'external' and 'internal' evaluation, the first being summative and the second being formative. This distinction between evaluation from the point of view of the 'creator' and evaluation from the point of view of the 'consumer' is a useful one when thinking about evaluation in the context of the interactive arts and the relatively new phenomenon of audience participation. Interaction between artwork and audience is something that distinguishes this form of art from traditional forms. Some have argued that evaluation is particularly important here, largely because human behaviour, and hence the realisation of an interactive artwork, is hard to predict. The artwork is only complete once someone interacts with it, so observation, whether casual or systematic, is needed to understand what has been created in visual, sonic, sensory form as well as the nature of the interactive experience itself. Interactive works that rely on audience participation for their full realization are more difficult to evaluate using a simple summative or formative distinction. Often it is the case that the artist creates a work that embodies features and parameters for participation that constrain the range of influences that an audience has on the manifestation of the work. The audience is 'allowed', 'enabled' 'invited', 'provoked' 'facilitated' to change the work in some way but only within the designed attributes created by the artist.

Strengthening the voice of the artist, and practitioner more generally is possibly one advantage of assuming a direct role in evaluation. The advent of more practice-based research by artists is transforming the way the role of evaluation in creative practice (Candy 2011). In the context of practice-based research in interactive arts development, evaluation has a particular role that facilitates a broader understanding of audience experience of artworks. It usually involves direct observation, monitoring, recording, analyzing and reflection as part of a semi-formal approach to generating understandings that go further than informal reflections on personal practice. Those who engage in this process are inevitably introduced to new ways of thinking about what their goals are and how to achieve them. Moreover, in order to carry out evaluation, it is necessary to learn new methods and techniques. The following section discusses different types of evaluation in art research and begins by addressing the contentious question of the role of measurement.

3.1.5 Evaluation in Art Research

Art occupies a high place in culture and society, and therefore some forms of critical investigation into art can raise controversy on a number of levels. For those for whom art makes an important contribution to society, the investigation and inquiry into its value is important. The debate about the value of art to society also runs side by side with the one about its economic value: this is an argument that surfaces continually and more especially during times of austerity when the allocation of public funding to art becomes more contentious. Evaluation of art, in its various forms, is

also contested ground where very different approaches to research and scholarship are applied. Sometime art evaluation focuses on the qualities of the artists, their circumstances and the fortunes of the times; sometimes the evaluation focuses on artefacts and involves measuring the impact of the artworks on the art market or scholarly opinion and publications. The area that is attended to can be evaluated using different methods and techniques and in the case of evidence based approaches involve both qualitative and quantitative data and analysis methods.

Measurement is also relevant to evaluation where it involves comparing different phenomena: for example, collecting data about different forms of observable behaviour and responses can be used to derive measures about audience engagement (Bilda 2011). Documenting interactive audience experience can provide examples for measurement. Each measurement is a case in itself with the people, processes, its context and outcomes as artefacts, installations, performances etc. Measurement is intended to provide consistent results across different cases at different times and that is why they are taken repeatedly to verify the previous measurements or to reach an average value (with an acceptable standard deviation) for a series of measurements. However, in order to really understand the nature of art experience, research has to be conducted outside controlled laboratory conditions, and cannot rely on fixed criteria that can be applied to all cases. The shifting ground and the ever-changing contexts often renders consistency difficult to achieve. Nevertheless, art experience can be accessible to a principled form of investigation, including by the practitioners themselves, using reflective and observational approaches. Measurement can also be useful insofar as it can provide the researcher with tools, or rather indicators, which can be used to probe more deeply into the similarities and differences between artistic processes. Quantitative measures can be used to reveal patterns of behaviour that can be used in tandem with observational data in live situations outside the laboratory as described in Chap. 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings") by Bengler and Bryan Kinns (2014).

But can we really measure the creative process and the artefacts that arise from it? Some people think it can be a powerful way of interrogating the status of art in the public domain and, at the same time throwing light on the way it is created. David Galenson, an economist, proposed that the variation in auction prices of a particular painter's worth could be accounted for, in part, by the values of a set of associated variables (size, support, and date of sale) at auction. He isolated the effect of an artist's age at time of painting a work from other variables and calculated the relationship between age and price. Using this kind of measurement, he showed that Picasso's most valuable work (Les Demoiselles d'Avignon) was painted at age 26 years whereas for Cezanne, high valuation came later in life: the highest price was of a Mont Saint Victoire painted at age 67 years (Galenson 2007).

Now we have to ask ourselves is this what we expect and wish the role of evaluation to be in the arts? In my view, if that was all that was happening, most people would agree that, whilst it is an interesting exercise, it rather misses the point about what, for most people, is the *real* value of art; in other words, qualities that extend well beyond its market value. In fact, Galenson's motive for using evaluation by measurement was a device to probe the nature of artistic creativity. He used

economic measures to understand and differentiate between artists' creative life cycles. What we are seeing in Galenson's approach is a way that measurement can be used to structure an analysis of creativity throughout an artist's lifetime. The measures are not there for their own sake but as a tool for interrogating information from the histories of artists' lives. By examining the careers of painters, sculptors, poets, novelists, he explores the nature of artistic creativity using a wide range of evidence and shows that there are two fundamentally different approaches to innovation, and that each is associated with a distinct pattern of discovery over a lifetime. Experimental innovators work by trial and error, and arrive at their major contributions gradually, late in life. In contrast, conceptual innovators make sudden breakthroughs by formulating new ideas, usually at an early age. By revealing the differences between experimental creative people and conceptual creators, he provides new insights into the lifetime processes of outstanding examples of creativity (Galenson 2007).

The kind of measurement that Galenson's work represents is rare because it uses measurement to develop further our understanding of the creative process. In the world of public art, evaluation that uses measurement to ascertain impact is more evident. Impact measures of evaluation are required to defend projects where public money is involved. For galleries and museums, success relies on:

- Measuring attendance
- Recording media presence
- Gaining national/international awards
- Meeting project goals and deadlines
- Surveying audience attitudes

This is where evaluation can indeed become dangerous ground. If the measures indicate that certain forms of art are popular, is that necessarily helpful to the health of the arts in general? Popular art is not necessarily art that stands the test of time. And does the kind of evaluation represented by measures of economic impact really sustain arts funding levels? As an example, in 2013, the UK creative industries account for around £1 in every £10 of exports and employ 1.5 million people but at a time of austerity, arts funding is being substantially reduced, indicating that no matter how impressive the measures of success are, economic and political pressures will nonetheless prevail. Impact measures are valuable for providing signs of accountability but they are not bullet proof.

Perhaps a more significant argument against evaluating the arts in terms of economic value or general popularity is a real danger that other values in art are submerged under these kinds of considerations. This leads to what Celine Latulipe calls 'The Value Reduction Problem':

> Justifying artistic and creativity projects by their economic impact is value reductionism. It does not honor the important role that arts and creativity play in the world, and it narrows the framework through which such projects are evaluated. It implies that creativity projects that do not lead to high ticket sales, innovation or economic growth are not worth while. (Latulipe 2013, p. 3)

The Value Reduction problem is that if creativity projects do not give rise to high impact and economic growth, by implication they have less value to society.

Latulipe argues that we need to assert art values over the political and economic values. One implication of her argument is that we need to adopt different forms of evaluation that are genuinely in the service of art practice (Latulipe 2013).

Far from constricting or constraining methods of art creation, more knowledge about ways of understanding art is likely to lead to novel and different forms of art. Understanding art better has different implications to those of typical research outcomes. In many fields, the principles and factors under investigation are settled. but for research in art and art evaluation, the ground is not so steady. Moreover, in the emerging digital arts, the source of new ventures does not always come from within the art community. Different kinds of contenders are bounding confidently onto the stage from science, design and technology, unencumbered by conventions and traditions, and bringing with them new methodologies as well as novel forms of art. The shifts that are taking place in our assumptions about what is possible are being driven by cross-disciplinary collaborative work in art and technology and with it has arrived new ways of experiencing art and new approaches to its evaluation. Before we move forward into that discussion, I want first to consider the nature of experience in art and the significance of interaction in art experience.

3.2 Experience, Art and Interaction

Before we can evaluate art, we need to see, to hear, to feel, to sense it, and not just once but several times. The experience of art is a precursor to evaluation: from our initial reflections on that experience, we may then move to a more considered judgement. But first, what do we mean by 'experience' when we speak of art? Every human being senses the world with perceptual faculties common to us all and yet each individual differs in the exact nature of that experience. The faculties we inherit are shaped and informed by the processes of growing up in a particular environment, being educated in a particular system and being exposed to the wider culture of the society we live in. There are many different positions within a society as there are across societies as to the role of art. For some, art has a vital place in the free expression of ideas and material forms, whilst at the same time having a primary role as the embodiment of cultural heritage and universal values. In the western culture that informs this discussion, art has a place in both cultural and commercial contexts and there is a special emphasis on the place of the artefact 'the art object'. That art object has been the basis of interminable debates, not only about its place in a given value system but whether it exists as an entity at all.

3.2.1 Art as Experience

Rather than attempt to represent all the diverse positions on art and experience in this discussion, I propose to focus on the ideas of John Dewey whose ideas on art as experience from the 1930s have a new kind of relevance to contemporary

developments in the emerging interactive digital arts. Dewey argues that art has a central role in the development of individual experience through its role in what he refers to as 'intensification'.

> The esthetic (i.e. perception and enjoyment) is no intruder in experience from without… but …is the clarified and intensified development of traits that belong to every normally complete experience. (Dewey 1934, p. 48)

Thus, for Dewey, the substance and form of a work are such that it can "enter into the experiences of others and enable them to have more intense and more fully rounded out experiences." (Dewey 1934, p. 113). His account of the act of experiencing draws on psychological theories, in particular, the development of what is known as functional psychology and in his time he attempted to refocus the attention given primarily to the material artwork itself (the 'art object') that was dominant in the early part of the twentieth century, in the direction of the totality of the process itself where the artist, artwork and audience are brought together in the creation of a new 'experience'. He was not arguing that the art object had no intrinsic significance, but instead, wished it to be recognised as the primary site for the process of experience. By way of the art object, the artist and the viewer (participant) encounter each other: thus, the 'doing' (creative artistic making) and the 'undergoing' (appreciation and interpretation) are brought together.

> The work of art is complete only as it works in the experience of others (Dewey 1934, p. 110)

If we accept the view that an artwork exists as experience once it is manifest to the world, then being able to judge the quality can only be undertaken (by anyone other than the creator) once it is finished and exhibited. The audience's appreciation, the critic's assessment, the art historian's perspective on what has been achieved is applied to something given over to public scrutiny. Looked at in this way, there is a point in the creative process when artists relinquish control and allow their work to be 'completed' by others. This form of completion resides in the experience of the work that takes place in the heads and hearts of individuals and therefore, what is felt, said and understood has many dimensions. The experience referred to here is not necessarily dependent on the artist's skill, although that underpins the work itself but rather each person's responsiveness to the context and form that is presented to them. Dewey is at pains to stress that no matter how good the craft of art making is, this does not provide sufficient grounds for judging the value of art and the experience of it. This raises the question as to whether artworks can be judged on the basis of their intrinsic qualities in a way that is independent of the world's judgement.

Until recent times, it has been possible to assume that the form and material status of visual artworks would remain stable once in the public domain. Of course, there were always exceptions to this when artists were able to amend what was already out in public as in the 'Varnishing Days' at the Royal Academy when artists such as W.M. Turner, would take a brush to 'improve' a painting already hanging in a gallery and even moving it to a different position for better viewing. In music, the opportunities for changing a composer's original concept by way of interpretation via performance or filling in missing gaps in the score, has always existed and in

that sense, there is a major difference in the nature of those kinds of artworks for which 'final status' depends upon a second stage beyond the artist's initial creation: the dramatic and dance arts can be added to those works that are only fully realised once they have been performed. In drama, the text of a play is performed by actors, produced by a director and experienced live by theatre audiences, all of whom bring different judgements to the process and its outcomes.

In his discussion of the prehistory of interactive art, Ernest Edmonds (2011a) notes that Marcel Duchamp, John Cage and others were making artworks that became known as "open works" using the term introduced by Umberto Eco's in his 1962 essay (Eco 1989). Eco stresses that an open work is not one to which the audience can do what they like:

> The possibilities which the work's openness makes available always work within a given field of relations. As in the Einsteinian universe, in the 'work in movement' we may well deny that there is a single prescribed point of view. But this does not mean complete chaos in its internal relations. What it does imply is an organizing rule which governs these relations. (Eco 1989, p. 19)

Eco distinguished between a performer and a member of the audience, "an interpreter", but argues that, in the context of an open work, they are in much the same situation. Later in the 1960s, the proliferation of "Happenings" extended the range of participative experiences open to the public. For an extended discussion of this important precursor to today's interactive digital art see Edmonds (2011a), pp. 20–24. Edmonds differentiates between those early experiments in participation and how the range of experiences is extended by new technological opportunities.

The experience of interactivity itself brings with it a different perspective on art experience that will be explored further in the next Section.

3.2.2 Experience and Interactive Art

In many forms of interactive digital art, the art object is incomplete in its material form; the visual, auditory features of the installation or 'piece' as it is often called do not exist as a single entity. The audience or viewer present is transformed into a participant in the 'completion' of the work in the sense that their presence, captured for example, by camera or by sensors taking biofeedback readings, affects the visible nature of the work. By its very nature, interactive art involves exploring new forms of interaction, exploiting emerging technologies and trying to come to a fuller understanding of the implications of the many new developments in interactive systems for art.

In these types of interactive artworks, whilst the artists have, in effect, relinquished a degree of control over the completion of the work, nevertheless, they set the boundaries within which the audience experience takes place, and in doing this, the process of interaction is extended and 'observable' in certain respects. Audiences can be seen interacting and responding in ways that are not available when there is recourse only to innermost individual thoughts. It is, of course, possible to ask

people what they are thinking, or how they feel in relation to a given painting or music or dance performance. However, being able to observe how people they behave in terms of bodily movement, gesture, speaking, and other manifestations of response to the interactive experience is independent of what they might say about it after the event when asked to comment. In this sense, it is possible to argue that the act of participation itself provides opportunities for a different kind of understanding that does not have to remain a tacit experience. The interactive art experience that is recorded and played back to the participant can provide a new means of stimulating reflection on the experience. Admittedly, it is all too easy to oversimplify the question as to whether or not interactive experience is more accessible to external understanding. It is perhaps sufficient to say at this point that the nature of interactive art experience is increasingly the subject of practitioner research, not least because it affords opportunities for artists to explore the implications of creating open situations where the nature of the experience created can have immediate implications for their future artworks.

Observations of art as experience can provide the basis of one form of evaluation. To be able to evaluate something, we begin by trying to describe it, to which we could add to 'explain it' where explanation digs deeper into the physical and technical mechanisms at work that are often not immediately visible or obvious to the untrained eye. Once we have reached a stage of understanding of art as experience, it is then possible to assess whether it has affective power and also whether the artistic intentions are 'successful'. This is not a straightforward process and there are many interrelated forces at work in the shift from initial exposure to art as experience and specifically interactive experience, to being able to adopt a reflective mode of thinking and from there, a more considered viewpoint. This is rarely a simple linear process, but one involving inherent dependencies that enable the participant to eventually enter the zone of an evaluative mindset.

In the making of interactive art, being able to understand both audience experience and the technological basis that underpins and shapes it, brings us inevitably to the question of how to evaluate it both from an audience and artist perspective. For the creative practitioners, evaluation plays an essential role in the exploration of the implications of creating art that involves audiences in different ways.

3.3 Evaluating Interactive Experience

Evaluating interactive art experience includes observing and assessing the many different responses and behaviour which are dependent on the individual characteristics, expectations, emotions and cognitive states of the participating audience. Audience experience evaluation can be conducted using mixed methods such as direct and lateral observations in the context of experience, contextual enquiries (interviews with the audience during their experience of an interactive system) or workshops (where people are invited to experience and discuss an interactive artwork). These methods can help the interested parties – artists, interaction designers,

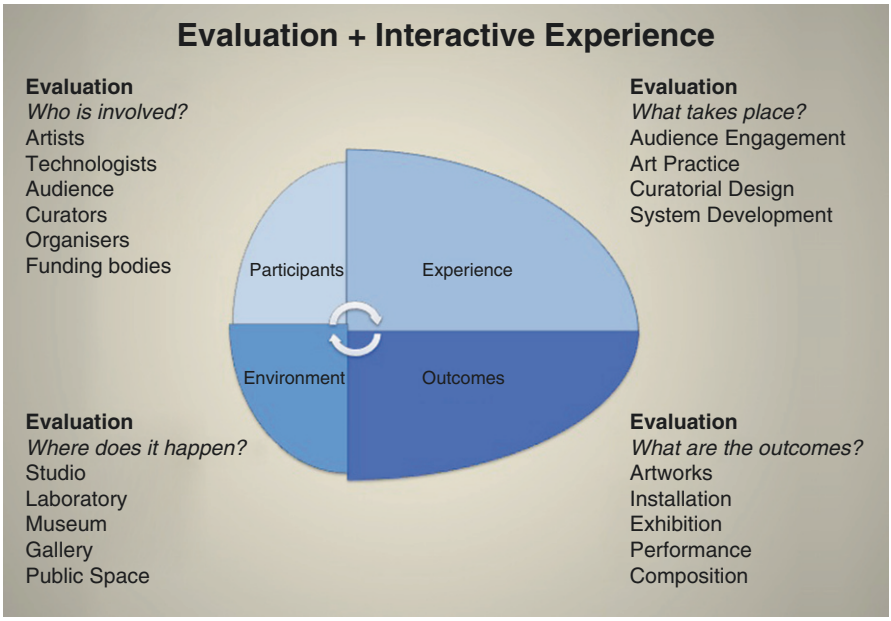

Fig. 3.1 Evaluation and interactive experience framework

curators – to understand the nature of responses such as the degree of engagement with the works, the feelings of control or otherwise, the way the works facilitate collaboration between people.

3.3.1 Frameworks for Evaluation

Before carrying out any form of systematic evaluation, it is important to consider the various dimensions of the scenario under consideration including the actors, environment, experience, art systems, as well as the features and qualities associated with them. The concept of a framework for scoping and guiding the actors and elements of a given creative process is a useful practical tool that many practitioner researchers are developing in the context of interactive art. In Chap. 2 ("Human Computer Interaction, Art and Experience", Edmonds (2014), recent examples of practitioner frameworks are described in detail.

Figure 3.1 below presents a generalised framework for defining the elements of an evaluative process with a view to identifying the features to be evaluated and any criteria, qualities or values that might be attached to them. It is based upon an earlier multi-dimensional model of creativity and evaluation comprising four key areas of creativity in the interactive digital arts (Candy 2012). It could equally be applicable to emerging forms of interactive system design envisaged by Hassenzahl and others mentioned previously.

Table 3.1 Actors, features and criteria for evaluation

Evaluation + experience	Actors	Features to be evaluated	Criteria for evaluation
Participants	Artists	Imagination	Levels or degree of:
	Technologists	Artistry	Motivation
	Audience	Expertise	Skill
	Curators	Skill	Education
	Organisers	Experience	Expertise
	Funding bodies	Intention	Engagement
		Reputation	Curiosity
		Success	Commitment
		Failure	Resources…
Experience	Audience engagement	Response	Positive
	Art practice	Behaviour	Negative
	Curatorial design	Attitudes	Opportunistic
	Art system	Risk taking	Adventurous
		Interaction	Curious
		Innovation	Cautions
		Design quality	Experienced
		Performance	Transcendent…
Outcomes	Artworks	Novelty	Leading edge
	Installation	Originality	Immediate
	Exhibition	Impact	Engaging
	Performance	Adaptability	Purposeful
	Composition	Aesthetics	Enhancing
		Effectiveness	Exciting
		Appropriateness	Disturbing
Environment	Studio	Physical spaces	Design quality
	Laboratory	Lighting	Convincing
	Museum	Facilities	Adaptable
	Gallery	Costs	Effective
	Public space	Time	Innovative
		Resources	Sufficient
		Effort	Sustained
		Constraints	Damaging
		Support	Copious

3.3.2 Principles and Criteria for Evaluation

The precise measures for evaluation are set by the specific context: for example, establishing criteria for evaluation of an interactive experience may focus upon the artist's intentions for the work in relation to audience. On the other hand the focus may be on the performance or behaviour of the work itself in any physical or technical environment. Table 3.1 shows four interrelated and interdependent elements: participants, experience, outcomes and environment each with associated features. It also indicates the kinds of characteristics or traits we might expect to find in

participants, experiences, outcomes and the environment in which interactive art experience is created and encountered. Against each of these it is possible to identify features to be evaluated and to identify criteria for evaluation expressed as envisaged qualities.

In participative interactive art, the audience experience has many dimensions. The experience can be immediate and short lived, or subtle and long term, depending upon the nature of the works. Evaluation studies have led to new insights into audience experience, for example, participants' behavioural patterns, different emotional responses and thinking processes (Bilda et al. 2008) that have led to the derivation of novel experience design principles for designing engaging interactive art systems (Bilda 2011). These principles can act as the basis for establishing criteria for evaluation of interactive experiences. For example, criteria can be expressed as follows: the audience/participants demonstrate active engagement in three ways: Immediate, Sustained or Creative. The particular criteria were described as:

- Immediate engagement: the work should gain immediate attention and yet is not so mundane as to create boredom.
- Sustained engagement: the work should excite curiosity and also be accessible to a general audience.
- Creative engagement: the work should excite immediate attention and encourage an audience to interact with it in a playful/purposeful way. As attention declines with familiarity and time, changes take place in the work that renew audience engagement.

Edmonds describes how categories of interaction have evolved during his exploration of the implications of creating artworks that are dynamic, responsive, ambient etc. (Edmonds 2010, 2011b). Costello also analyzed behaviour in her research on play enhancing art systems (Costello 2007) such as the participants' ability to experience discovery, danger, fantasy, camaraderie, subversion etc. and then went on to make and evaluate artworks based on that evidence (Costello 2011).

The criteria presented above might be very different for a museum curator aiming to evaluate the interactive experience from the audience's perspective in a given environment where existing constraints. When defining the criteria for evaluating an environment for interactive art and experience, the qualities of the physical spaces available are key factors in influencing the experience. Establishing an environment for interactive art evaluation involves establishing criteria such as the:

- degree of robustness of the art system in expectation of heavy public use
- appropriate accessibility in respect of type of audience (e.g. children)
- adherence to safety and house rules required by the museum
- impact of other coinciding exhibits (sound, noise, light impacts)
- attention to participant orientation and training
- attention to art system maintenance by creator and technical support

Evaluation on these lines can produce new understandings that inform the design of future interactive art spaces. In evaluating interactive experience, practitioners in the interactive arts have turned to practice-based research to develop a deeper level

of understanding about participant experience. There is already a rich source of experience of making evaluation an integral part of the creative and experiential process Candy and Edmonds 2011). For a further discussion of studies in interactive art practice and the important role of setting criteria for evaluation, see Candy (2012).

3.3.3 Methods for Evaluating Interactive Art Experience

Learning which methods are best for observing and recording people's interaction experiences and then making sense of it in ways that can be applied to future interactive systems is a significant challenge in itself. Many studies involve observing closely and asking the right questions. At times, artists needed to watch the audience without interruption and at other times, usually immediately following first interactions with the work, they needed to engage them in recalling what they did and how they reacted to their experience. To be able to do this successfully required an understanding of appropriate research methods and how to apply them. Some examples of evaluation approaches and methods that are being used in the development and evaluation of interactive art systems adopting HCI and Digital Arts research are drawn from contributions to this book. The scenarios are:

- In vivo versus in vitro – the need for real world settings
- Eliciting Audience Responses to Experience
- Reflective practice in formative evaluation

3.3.3.1 In Vivo Versus In Vitro – The Need for Real World Evaluation Settings

Investigating audience experience in interactive art requires a research process that draws upon actual events or what we might call 'in vivo' situations, as distinct from 'in vitro' or laboratory based scenarios. It could be argued that all interactive art is 'in vitro' (to some extent) as the artist creates the artificial environment in which people interact with the art. The question is, what distinguishes 'in vivo' from 'in vitro' in the context of evaluating interactive art. Audio and video data is gathered in such a manner as to provide as accurate a picture of events as can be obtained. The data analysis that follows must also be carried out in a manner that affords genuine insight into the nature of the raw picture that has been obtained. All this is critical to how soundly based the findings are, as researchers into complex human processes are all too aware.

Chapter 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings") by Bengler and Bryan Kinns (2014), illustrates this point very ably. The approach to evaluation described was driven by a strong interest in interactive environments that foster public creativity, not only the user interactions with the creative system, but the social behaviour shaped by the scenario created.

Ethnographic methods were adopted for uncovering how people behave and interact with *Polymetros*, a collaborative music making system within a real-world context. They gathered a variety of types of data such as field notes, video observations, self-report questionnaires and user-system interaction log data of the interactions of large numbers of people in a public museum setting and analysed them in such a way as to be able to compare findings with similar studies. Data collection "in the wild" requires an acceptance that there is less control over events than possible in a lab type setting laboratory environment. In terms of a public museum, this meant being responsive to institutional concerns and regulations, amongst other considerations. The logging mechanisms built into *Polymetros*, also enabled them to capture information about musical patterns created that revealed how people responded to one another musically. A key finding was that feeling part of a collaborative, creative musical process seems closely related to the sense of control that the participants has over their individual contribution. The challenge for design identified from this was how to:

> …balance a deep level of interactivity to open up real possibilities for musical creation while allowing every participant to experience an individual sense of musical control.

The evidence indicates that evaluation conducted in this way can serve a number of different purposes, from informing the future design of new types of systems for creative uses to bringing a better understanding of the social dimensions of public art experience. The methods themselves were not new but were being deployed in a new context, a public museum with large numbers of people. The lessons for evaluation that were learnt were applied to museums in different cultural contexts.

3.3.3.2 Eliciting Audience Responses to Experience

Identifying well-tested methods for eliciting audience views about their experience of interactive art is only the first step, however. Learning how to adapt and customise to suit the particular context is a necessary second step. In audience studies, asking people what they were doing and thinking, using simple 'think aloud' techniques even immediately after the interactive experience, does not always provide accurate or sufficiently rich information. This was partly because of the difficult nature of capturing the complexity of everything that was going on but mainly because of the (understandable) inability of the participants to recall everything in sufficient detail to satisfy the need for a rich, detailed picture of events. And so, video-cued recall was introduced into interactive art audience research (Costello et al. 2005).

Video-cued recall involves playing back video recordings of audience interactions and eliciting a commentary from the individuals concerned. As soon as participants have finished their session, the recording is played back to them. As it plays back, they are asked to provide a running commentary of what they were thinking and feeling as they experienced the artwork. The initial recording captures the participant's live experience while the verbal commentary provides possible insights into what was being thought or felt at the time. Although the participant is making this

commentary after their artwork experience, the video reminds them of and keeps them focused on the moment-by-moment events of their live experience.

As described in Chap. 13 (("Evaluation in Public Art: The Light Logic Exhibition") by Alarcon et al. 2014), this technique was used in conjunctions with post event structured interviews and it is the voices of the audience as participants that inform the artist and the curator about the experiences they underwent. Information was derived from data acquired through structured interviews and video recordings that was analysed independently by several researchers and then evaluated by the artist and curators. From both sets of data, several categories of findings were identified based upon the questions about audience response, curatorial design and the effect of carrying out this kind of exercise with the public.

3.3.3.3 Embedding Formative Evaluation via Reflection in Action

The role of reflection-in-action, first proposed by Donald Schön (1983), has proven to be effective in supporting the individual process of critiquing actions and developing practitioner knowledge. Reflective practice can be used as a strategy for challenging existing practice and at the same time generating new understandings. One of the most appealing aspects is that it validates intuitive instincts within a framework of reflective enquiry. Moreover, it provides an opportunity to document the process of reflecting-in-action as it takes place. Documentation can then be returned to later for further reflection. How to document reflective practice and use it effectively is a skill that has to be learnt. This is an approach that has found new applications in the context of digital arts: see for example Muller 2011; Burraston 2011.

The approach to evaluation described in Chap. 7 ("Intimate aesthetics and facilitated interaction") by Loke and Khut (2014) draws upon reflective practice in a new way by embedding it into the live process of interactive participant experience. This type of formative evaluation incorporates strategies for reflection by the audience that are an integral part of the artwork itself. The aim is to make experience of the art and its evaluation a co-evolutionary process. Not only is this an innovative way of doing evaluation, it also poses challenges to conventional art making and exhibiting practices. The evaluation process centres on the use of the 'Facilitated Interaction Framework' which was developed from body oriented (somatic) practices such as yoga, dance and performance rituals. It comprises four stages of audience experience and participation that can be used to frame the development and evaluation of live participative art experience:

> …the framework highlights the social nature of these kinds of intimate transactions in public spaces, where onlookers or spectators may be present in the exhibition environment and able to view some or all of the interacting participant's experience. We refer to this aspect as a witnessing of experience by audience.

Documentation of participant experiences includes body maps whereby participants are invited to contribute a response to the work in the form of a hand-drawn experience map and recorded interviews. The art experience work is presented to participants

as an opportunity to share experiences with others. The problem of being able to verbalise responses immediately after going through strong immersive experiences is handled by post experience interviews. The outcomes from these interviews are an integral part of the art experience itself.

3.4 Conclusions

There is a wide variety of methods and techniques that can be deployed in the creation and evaluation of new forms of interactive art systems, installations and exhibitions. Many of the methods are already in use in HCI and Digital Arts practice. However, it is often necessary to adapt them in order to meet the requirements of the context in which the work is taking place. The chapters that follow represent a range of approaches and methods including:

- facial recognition techniques for evaluating emotional response
- visualisations for identifying patterns of collaborative behaviour
- ethnographic methods for evaluating collaborative musical performance
- embedding reflective practice into interactive experience and evaluation

Practitioners from interdisciplinary fields explore varied dimensions of creative work and how research has played a part in expanding their ability to reflect, observe and evaluate as an integral part of making interactive works. The approaches to evaluation range from the quantitative and qualitative to the reflective and empirical, all of which provide insights into differing forms of the interactive digital arts. There is no recipe book from which to select and apply a set of procedures and techniques, but rather a set of rich scenarios in visual art, music, games, dance, performance, collaboration and above all, shared experience in developing and evaluating interactive works that aim to stimulate, challenge and delight the public at large.

References

Alarcon-Diaz X, Askaroff K, Candy L, Edmonds EA, Faram J, Hobson G (2014) In: Candy L, Ferguson S (eds) Interactive experience in the digital Age: evaluating new art practice. Springer, London, pp 187–208

Arts Council of England (2013) http://www.artscouncil.org.uk/selfevaluation/. Accessed 9 June 2013

Bengler B, Bryan Kinns N (2014) In the wild: evaluating collaborative interactive musical experiences in public settings. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 169–186

Bilda Z (2011) Designing for audience engagement. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 163–181

Bilda Z, Candy L, Edmonds EA (2008) Designing for creative engagement. Interact Desig Creat Pract (special issue Design Studies) 29(6):525–540, Elsevier

Boden MA (1990) The creative mind: myths and mechanisms. George Weidenfeld & Nicolson Ltd., London

Burraston D (2011) Creativity, complexity and reflective practice. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 33–59
Candy L (2011) Research and creative practice. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 33–59
Candy L (2012) Evaluating creativity. In: Carroll JM (ed) Creativity and rationale: enhancing human experience by design. Springer, London, pp 57–84
Candy L, Edmonds EA (2002) Explorations in art and technology. Springer, London
Candy L, Edmonds EA (2010) The role of the artefact and frameworks for practice-based research. In: Biggs M, Larsson H (eds) The Routledge companion to research in the arts. Routledge, New York, pp 120–137
Candy L, Edmonds EA (eds) (2011) Interacting: art, research and the creative practitioner. Libri Publishing Ltd, Faringdon
Cockton G (2008) Revisiting usability's three key principles. In: Proceedings of the CHI08 extended abstracts. ACM Press, New York
Costello B (2007) A pleasure framework. Leonardo 40(4):370–371
Costello B (2011) Many voices, one project. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 182–194
Costello B, Muller L, Amitani S, Edmonds EA (2005) Understanding the experience of interactive art, iamascope in beta_space. In: Pisan Y (ed) Proceedings interactive entertainment. Creativity & Cognition Studios Press, Sydney, pp 49–56
Crabtree A (2003) Designing collaborative systems: a practical guide to ethnography. Springer, Heidelberg
Dewey J (1934) Art as experience. Capricorn Books, Paragon, New York, 1959
Eco U (1989) The open work. Harvard University Press, Cambridge, MA. First published in 1962 as Opera Aperta
Edmonds EA (2010) The art of interaction. Digit Creat 21(4):257–264
Edmonds EA (2011a) Interactive art. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 18–32
Edmonds EA (2011b) Art, interaction and engagement. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 228–241
Edmonds EA (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23
Edmonds EA, Candy L (2010) Relating theory, practice and evaluation in practitioner research. Leonardo J 43(5):470–476
Galenson D (2007) Old masters and young geniuses. Princeton University Press, Princeton
Graham B, Cook S (2010) Rethinking curating: art after new media. MIT Press, Cambridge, MA
Greenberg S, Buxton B (2008) Usability evaluation considered harmful (Some of the time). In: Proceedings of the CHI2008. ACM Press, New York
Harker S (1995) The development of ergonomic standards for software. Appl Ergon 26(4):275–279
Harris C (1999) Art and innovation: the Xerox PARC artist-in-residence program, Leonardo book series. MIT Press, Cambridge, MA
Hassenzahl M (2004) The interplay of beauty, goodness, and usability in interactive products. Hum Comput Interact 19(4):311–318
IXIA (2013) Public art: a guide to evaluation, IXIA PA limited. http://ixia-info.com/research/evaluation/. Accessed 28 Nov 2013
Johnston A (2014) Keeping research in tune with practice. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 49–62
Jordan PW (2000) Designing pleasurable products. Taylor & Francis, London
Kuh K (1962) The artist's voice. Da Capo Press, New York (January 14, 2000)
Latulipe C (2013) The value of research in creativity and the arts. In: Proceedings of the 9th ACM conference on Creativity & Cognition. ACM Press, New York, pp 1–10
Loke L, Khut GP (2014) Intimate aesthetics and facilitated interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 91–108

Muller L (2011) Learning from experience – a reflective curatorial practice. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 94–106
Preece J, Rogers Y, Sharp H (eds) (2002) Interaction design: beyond human-computer interaction. Wiley, New York
Schön DA (1983) The reflective practitioner: how professionals think in action. Basic Books, New York and reprinted Ashgate Publishing Ltd., Aldershot, Hants, 1991, 2003
Sommerer C, Mignonneau L (2009) Interactive art research. Springer, Wien/New York
Sternberg R (1999) Handbook of creativity. Cambridge University Press, Cambridge
Sullivan G (2010) Art practice as research: inquiry in the visual arts, 2nd edn. Sage Publications, Thousand Oaks
Sweeney M, Maguire M, Shackel B (1993) Evaluating user-computer interaction: a framework. Int J Man Mach Stud 38(4):689–711. Academic Press
Tractinsky N, Adi SK, Ikar D (2000) What is beautiful is usable. Interact Comput 13(2):127–145

Chapter 4
Keeping Research in Tune with Practice

Andrew Johnston

Abstract This chapter examines the relationship between practice, research and evaluation with reference to the design and development of interactive systems for use in a large-scale dance work developed in collaboration with Stalker Theatre, *Encoded*. Strategies for keeping creative practice and the associated research aligned with the concerns of practicing artists are presented. These strategies include working with experienced, high-calibre artists, applying user-centred, iterative design and development approaches, and carefully examining the impact of new technologies and techniques on performers' practices and experiences. Findings from an examination of Stalker Theatre's experiences with the *Encoded* systems indicate that the use of interactive systems in live performance has a significant impact on the way performances are developed, staged and structured.

4.1 Introduction

This chapter reflects on the ongoing application and development of practice-based research methods in the domain of live music and dance performance. The 'practice' here involves the collaborative development of interactive systems which respond to performers' actions and produce real-time sounds and visuals. These are visible to both audience and performer, and the intention is to facilitate a creative dialogue between performer and system by providing a rich and stimulating environment for improvisation.

Engaging in practice-based research demands careful consideration of the relationship between practice and research. A core question that needs to be considered

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at the outset is: who is this research for? Ontological and epistemological positions flow from this. In the case of the work described here, the creative practice is focused on the design of interactive systems for use in live performance. The 'audience' for this research is artists and designers who are engaged in similar work. Thus any techniques, findings, theories or observations that arise from this work are evaluated in relation to creative practice and the relevance, utility and/or impact they have for those people.

Following from this, a key concern has been to keep the evaluation (a term used in the broadest possible sense) of the interactive systems grounded in creative practice. Just as Glaser and Strauss (1967) sought to develop an approach to theory development in sociology, which was intimately linked with the words and actions of people in the situations under study, we pursue a number of strategies to keep creative practice and associated research closely tied to the concerns of practicing performers. These include:

- Working with experienced and high-calibre artists.
- Iterative development in close collaboration with artists.
- Meaningful examination of the impact of interactive systems on the creative practice and experiences of performers.
- Engaging performers in reflection on all aspects of the work, usually in interviews.
- Analysing data gathered during interviews as a final reflective step to generate theory linked to practice.

4.2 Background: Practice Based Research

Since 2004, we have developed a series of interactive performance works which use what could arguably be termed 'natural user interfaces' or 'reality-based interaction' (Jacob et al. 2008). The term 'natural' is potentially controversial (Norman 2010). Here it is used specifically to refer to interfaces based on simulations of physical systems: i.e. interfaces which respond to user gestures in ways which are intuitively understandable because they are based on the laws of Newtonian physics. In practice, this means that performers' gestures (directly from the body or via a musical instrument) influence what appear to be physical objects projected on a large screen. In response to the performers' gestures, the objects move and, at times, create sounds in ways that are physically plausible.

There are a number of advantages to using this strategy. The primary one from the point of view of someone designing for expressive musical or physical performance is that it supports the creation of systems which are intuitively understandable and controllable, while simultaneously exhibiting rich, complex and nuanced behaviours. Works which use this basic approach include *Partial Reflections* and *Touching Dialogue* (Johnston et al. 2008, 2009; Johnston 2011). More recently, the interactive systems developed for the Stalker Theatre production, *Encoded*, have refined and extended this technique.

These works were developed as part of a practice-based research project conducted at the *Creativity and Cognition Studios* at the University of Technology Sydney. The 'practice' in this case is the collaborative creation of interactive systems for live performance. The 'research' involves reflection on the creative process and careful examination of the experiences of performers with these systems.

This has three main aims:

- evaluation of the systems in terms of relevant design criteria;
- examination of performers' experiences with the systems; and
- examination of performers' practice in relation to the interactive systems.

Outcomes of this process can include design criteria based on artistic practice, theories relating characteristics of the interactive systems to performer experience and creative practice, documentation of artists' creative practice in relation to the new systems, and the works themselves (Edmonds and Candy 2010).

4.2.1 Encoded

Encoded is a large-scale dance work which premiered in November 2012. *Encoded* explores how notions of digitised space alter our perceptions of physical space. By using a combination of large and small-scale interactive projections onto the performance space and the dancers themselves, *Encoded* attempts to blur the boundaries between physical space and digital space.

A core concern with this work was how to realise the interaction between performers and the digital elements of the environment. It would certainly be possible to simply consider the physical performance environment and the dancers' bodies simply as 'surfaces' upon which various pre-prepared images and videos could be projected but in some ways this would seem to reinforce the boundaries between the physical and the digital rather than provide an opportunity to explore them.

The approach that was developed is closely related to the *Partial Reflections* and *Touching Dialogue* works described above, in that a simulated physical system is used as a mediating layer between the physical gestures of performers and visuals and sounds produced by the computer. However, rather than using a simulation based on solid objects which are linked together, *Encoded* uses simulated fluid (Fig. 4.1), based on a heavily modified version of the excellent MSAFluid simulation by Mehmet Atken.[1] Figures 4.1 and 4.2 show the system in action. Video of a recent performance can be seen at: http://vimeo.com/55150853.

The intention is that the appearance and behaviour of the software-simulated fluid will be intuitively understandable for both performers and audience, yet complex enough to facilitate conversational interactions.

[1] http://www.memo.tv/ofxmsafluid/

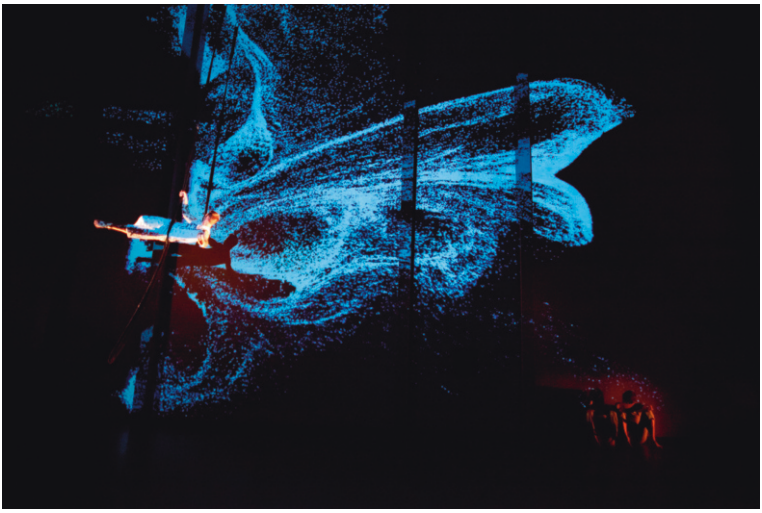

Fig. 4.1 Moving particles from the fluid simulation are projected upon the performer. The performer's movements 'stir' the fluid that flows over and around their body (Photograph reproduced with kind permission of Matthew Syres)

Fig. 4.2 Rick Everett and Lee-Anne Litton of Stalker Theatre perform with the *Encoded* system. The visual appearance and behaviour of the fluid simulation at the core of the system can be changed significantly in real-time (Photograph reproduced with kind permission of Matthew Syres)

4.3 Strategies for Practice-Based Research

A number of strategies for keeping research 'in tune' with creative practice have evolved during the creation of the works described above. This section presents these strategies and places them in the context of a framework for practice-based research.

4.3.1 Work with Experienced, High-Calibre Artists

The works described here involved close collaboration with performers who are already have a high degree of proficiency in what might be termed 'non-digital' disciplines: music (played on acoustic instruments), dance and physical theatre. These are professional musicians, dancers and choreographers who are highly experienced and well regarded in their fields.

There are a number of reasons for wanting to work with artists of this calibre. The primary one is that they are inspiring to work with and able to present the works that we develop in the best possible light. Beyond this though, in general these artists are also articulate about their experiences with new interactive systems and its impact on their practice. This might be surprising, as it might be expected that practising artists would primarily be concerned with performing and not necessarily interested in theorising about the process. However, perhaps because the interactive systems that we work with have such direct and obvious impacts upon the experiences of performers, and because these kinds of systems are still relatively new, the performers appear to have little difficulty talking about their experiences and how the use of the systems impacts upon their creative processes. Another reason for this, perhaps, is that we use the language of performance to talk about their experiences. This is particularly important during more formal evaluations of the systems. Crabtree argues that ethnographic researchers need to have (or at least develop) 'adequate mastery' of their domain of study, in order that they, "can recognize as members recognize *what* is going on in the phenomenal field of practical action under study and *how* it is getting done" (Crabtree 2003, p. 81, italics in original). This implies that, when evaluating systems designed for music or dance performance, it is important that those conducting the evaluation understand the creative domain and are able to converse with the performers in that language. The focus of the conversations should be on the experiences of the performer and their creative strategies, using the language of performance, and not technical, computer-related terms.

We have found that experienced performers are willing to explore the boundaries of their practice and consequently open to the possibility of using interactive systems in creative ways. Even performers working in what might naively be considered 'conservative' environments of symphony or opera orchestras, are often extremely engaged with new music and approaches to performance.

4.3.2 Iterative Development in Close Collaboration with Performers

Working closely with performers to develop a new work is a strategy that helps maintain the connection between the interactive systems that are developed and the creative interests of the artists. Finding an appropriate balance between working *with* a performer and working *for* them can be difficult. By this it is not implied that performers seek to dominate the relationship, although this can of course occur. It is perhaps more often the case that software developers want to be dominated! Software development culture and methods have traditionally encouraged a kind of 'gun for hire' mentality amongst software developers leading to a, "just tell me what to do and I'll do it" attitude. In this view, the artist is the 'customer' who specifies (in detail, in advance) exactly what the computer system should do, and the software developer is the 'technician', solely responsible for solving all the associated technical problems and creating software which does exactly what the customer specified. As has long been acknowledged in the participatory design and agile software development literature, this approach rarely leads to satisfactory outcomes.

By definition, genuine collaboration involves openness, frequent feedback and a willingness to change direction. To some extent this openness to change is in conflict with traditional software development methods, which are predicated on the notion that the design of the software should be fixed in advance and any changes minimised. Agile software development methods have, arguably, largely addressed this issue, insisting on frequent informal communications between developer and users, and on a culture of 'embracing change' (Beck 1999).

Our experience suggests that creative collaborations work best when the relationship is one of 'full partnership' (Candy and Edmonds 2002). These are situations where the software developer is fully engaged in the creative process, responds to ideas, is willing to compromise when necessary, but is also prepared to argue against compromise if they feel this is warranted.

4.3.3 Examine and Document the Impact of New Interactive Systems on Performers and Their Performances

The relationship between practice and research in practice-based research remains a point of contention. Frayling (1993) has argued for three categories of research in the area of art and design: research *into* art and design, research *through* art and design and research *for* art and design. While these categories are contentious, especially in relation to the status of research *for* art, they help to situate the research described in this chapter.

In Frayling's terms, research *into* art and design involves the examination of aesthetics, history, perception and theoretical perspectives. Research *through* art and design is concerned with the exploration of new materials, new applications of

existing materials and reflection on creative practice. Finally, research *for* art and design consists of research targeted at the creation of a specific work, or perhaps a series of works. Frayling describes this as research,

> where the thinking is, so to speak, *embodied in the artefact*, where the goal is not primarily communicable knowledge in the sense of verbal communication, but in the sense of visual or iconic or imagistic communication. (Frayling 1993, emphasis in original)

The research described in this chapter draws on all three categories, but the focus of this chapter is primarily on the first two. Because the work involves the creation of artworks there is, of course, a significant amount of research *for* art and design, involving exploration of themes and the gathering and consideration of materials. The outcomes from these activities are incorporated into the final work, but often in ways which are hard to precisely identify or explain in words. However, this kind of research is critical if the work is to be effective as an artwork, and without it the research *into* and research *through* art and design will be significantly compromised.

While research *for* the artwork is necessary and important, the comparatively recent use of digital technologies in live performance, and their continued rapid development, means there is an opportunity for broader contributions beyond the artwork itself. First, there is of course the design and application of the technologies themselves. Many digital artists develop new tools and/or technologies as part of their creative practice. Where these are novel in themselves, or used in novel ways, this can of course be a contribution to the field. In Frayling's terms, this is research *through* art and design.

What is of particular interest here though is the opportunity that these new applications of technology provide to examine creative practice. The use of interactive technologies in dance, for example, has an impact on every aspect of the work, touching on the practice of performers, choreographers and directors as well as lighting, costume and set designers. In a sense, there would be little point in developing the systems in the first place if they did not disrupt – hopefully productively – existing approaches.

This is research *into* art and design, which here involves careful *evaluation* of the digital systems which are developed and used in performance, but also *examination* of creative practice in relation to those systems. All creative artists reflect upon and evaluate their work in order to learn and develop their personal aesthetic and abilities. The aim here though is to develop theories and techniques which are more broadly applicable, or at least of interest to others working in this domain. These theories are essentially 'middle-range' theories (Merton 1957), in that they are based on data gathered from interviews and observations, as opposed to more abstract 'grand theories' less concerned with empirical evidence.

It has been our experience that while working closely with performers during development leads to the development of effective "theories-in-use" (Schön 1983), more formal studies help make these theories more explicit. The form of the studies can include interviews with the performers who are involved in the work as well as

more experimental studies in which performers who are not familiar with the interactive systems experiment with them and are interviewed about their experiences.

The performers involved here have generally had less interest in the formal studies than in the immediately practical concerns of creating works and putting on a show. However, it is often the case that beyond the higher-level theories which emerge from these studies, artists often do receive immediate practical benefits. The process of sitting down for an hour or longer and talking in depth about their creative practice and the interactive systems which have been developed often leads to new insights for the interviewee as well as the interviewer.

A final benefit of more formal studies is that the interviews document the work of the performers concerned and the artistic concerns which drive their work. As video technology becomes increasingly sophisticated and ubiquitous, artists are becoming increasingly adept at documenting their performances and artworks. However, it is less common to document performers' perspectives on their performances and the motivations behind them. Given that these creative concerns are likely to change over time, there is value in documenting these more ephemeral concepts as well as their physical/technical manifestations.

4.3.4 Analysing Data Gathered During Interviews as a Final Reflective Step to Generate Theory Linked to Practice

Interviews and video data gathered during user studies are a rich source of data, and it can be a challenge to make sense of this. Analysis of this data is a final opportunity to reflect on the interactive systems and their impact (or lack of it) on the performers' practice.

For the work described here, the grounded theory methods (Glaser and Strauss 1967; Glaser 1978) were used to help us take full account of everything that performers say or do during the studies. These methods are essentially extremely simple, but time-consuming, techniques which enable the minute examination of interviews and facilitate the construction of theories 'grounded' in this data.

From a purely pragmatic point of view, the methods also help ensure that the researcher genuinely takes account of what the interviewees are saying and is not blinded by her or his own pre-conceived notions. Having said this, there is of course nothing in grounded theory methods which guarantees objectivity. The methods are ultimately interpretive and do not aim to produce objective, generalisable findings.

4.4 Practice-Based Research and Evaluation

Linda Candy asks in Chap. 3 ("Evaluation and Experience in Art") (2014) the question: "Why is *evaluation* in the context of art seen as a problem?" She argues that, often, evaluation is perceived as:

– taking more time and effort than the results warrant;
– conflicting with creativity, because it risks reducing creative work to a process of completing checklists; and/or
– ignoring important qualities of artworks and people's experience of art because they are difficult to measure.

Our experience has been that while these risks are real, evaluation in creative work can lead to insights and improved understanding of design and creative processes. As Candy points out, artists already embrace evaluation implicitly in as part of every artistic decision that they make. Even artists such as John Cage, who embrace chance operations in order to reduce or remove the influences of their personal preferences in music, choose ways of linking randomness to sonic events. As part of this process they must necessarily consider alternate links, evaluate them in some way, and select one for a particular work.

Given these evaluative processes at the heart of creative practice, it is probable that the biggest barrier to acceptance of broader types of evaluation in the field is the term 'evaluation' itself. Some researchers are proposing new ways of thinking about evaluation in the context of systems which have uses that are open to a range of interpretations. Sengers and Gaver (2006), for example, argue that interaction designers are becoming less concerned with designing software which unambiguously conveys and supports a clearly defined 'purpose'. They propose that HCI needs to support interactions in which users may have multiple interpretations of what a system is for and how it works. 'Evaluation' in this context goes beyond identifying whether users' interpretations of a system's purpose and behaviour matches the designer's anticipated interpretation. Rather,

> evaluation shifts from determining whether an authoritative interpretation was successfully communicated to identifying, coordinating, stimulating, and analyzing processes of (evaluative) interpretation in practice (Sengers and Gaver 2006, p. 105)

This approach suggests we move beyond 'evaluating' our designs, and use examination of users' experiences to support reflection on both interactive system design and the nature of the activities they afford. That is, we move beyond evaluating how effective our designs are at supporting creative expression, for example, and instead use them as provocative prototypes (Mogensen 1992), which stimulate examination of the nature of expression itself - as it occurs in a particular cultural context.

With this in mind, we see two 'traps' for artists and researchers in relation to evaluation:

- Focusing on the artefact and neglecting the goals, behaviour and experiences of those who use it – and how these may differ from what was anticipated; and
- Premature commitment to, and evaluation against, particular design criteria.

Because our work is primarily concerned with developing interactive systems for use in performance, we are careful to ensure that as well as *evaluating* the systems, we more broadly *examine* the full context of use. The term 'examine' here is deliberately chosen to indicate our intention to look beyond whether or not the system has met the design criteria we established, and instead see the system as a kind of

'probe' which may disrupt performers' habits. These disruptions can highlight habits which may not have otherwise been readily apparent, and can help throw performers' creative practices into sharp relief.

Framing these studies as *examination*, as opposed to evaluation, of the experiences of performers in the context of using a new interactive system is intended to keep the scope of investigation broad and allow us to discover any new approaches, conceptions and techniques which performers may develop. Keeping examinations of creative practice broad and open helps keep design criteria malleable. During creative development, the design criteria for our interactive systems are in flux. It is often the case that an element of the system intended for a particular use was repurposed. The improvisatory nature of the workshops which explored the *Encoded* interactive systems was deliberately fostered in order to continually re-examine their purpose and characteristics. Committing to a set of design criteria too early in the creative process, and evaluating the systems in those terms, would have risked shutting down options before they were even considered.

4.5 Performers' Experiences with Encoded

The work *Encoded* was the end result of collaboration with Stalker Theatre, a dance/physical theatre company based in Sydney, Australia. As outlined previously, the work involved developing interactive systems in which the body movements of performers 'stirred' large projections based on computer-simulated fluid.

The creative development of the interactive systems for *Encoded* drew on theories of interaction and mapping (the linking of physical gestures to computer-generated audio visuals) to attempt to create an environment which encouraged conversational interaction (Johnston et al. 2008; Johnston 2011).

It is important to stress that 'conversation' in this context does not refer only to interactions directly analogous to human spoken conversation. In human-human conversation there are comparatively long time periods between one person saying something and the other person responding. The interactive conversation which we were aiming for in *Encoded* involved less structured turn-taking and much faster and more immediate feedback. As one of the interviewees observed, the interaction style is more akin to that experienced by practitioners of 'contact improvisation' (Paxton 1975) in which two dancers improvise while maintaining close body contact at all times. While one or the other dancer may take the initiative at particular times, the presence of direct physical feedback enables rapid and subtle communication and shifts in the balance between performers.

To explore the experiences of the artists involved with the *Encoded* systems, detailed observations of the rehearsal and development process were conducted and a series of interviews undertaken at different stages of the approximately 18 month development period.

Analysis of the interview and observation data lead to the identification of a number of key themes. These included:

- The environment for interaction;
- The process of assembling 'components' of the show into a coherent whole;
- A degree of separation between the choreography and interactive system; and
- A trajectory of creative development which began with improvisation and ended with composition.

4.5.1 The Environment for Interaction

Even though *Encoded* was a show which made extensive use of interactive systems, the existing and well-established techniques used in staged performances often work to prevent performers themselves feeling that there is much interaction going on. From a purely practical point of view, the fact that dancers are working in a space which is lit by powerful stage lights, as well as high-power projectors, means that their vision is significantly impaired.

> It's very hard [laughs] to interact when so often the, um, ability to see is compromised, whether it's by lights in the eyes or projectors in your face… (Performer 2)

For stage performers this of course is not uncommon. The implications for designers of interactive systems for live performance though, are significant. If there is a desire for interactive systems to be used instrumentally or conversationally, then it will almost certainly be necessary to present the work in non-conventional settings.

Apart from lighting, there are also practical problems with positioning the audience in relation to the performers and the projections. In order for the audience to see both, the *Encoded* audience was placed in a more-or-less conventional position looking onto the dance floor with projections on the wall behind the performers. This meant that if performers were to meaningfully interact with the projections then their attention would need to be taken away from the audience, at least to some degree.

> Um, I think in this performance, um, if you have, it's funny I think because my back was so often to the visuals on the wall behind me… or you know or my performance presence is so often projected in the direction of the audience that I don't know how often my attention was really drawn back to the visuals. (Performer 2)

4.5.2 The Process of Assembling 'Components' into a Coherent Whole

In general, the performers in *Encoded* saw themselves as part of a larger whole that was assembled by the director and choreographer. Partly, this was due to the scale and architectural style of the performance space (a large nineteenth century railway carriage works, repurposed as an arts venue), and the correspondingly large scale of

the computer projections. This made it more difficult for the performers to get a sense of how their actions fitted in to the work as a whole.

This process was a familiar one for performers, as the quote below illustrates:

> …it's often the case in performance and dance performance that the dancers are…performing the steps but it's this kind of grand vision that's creating the work, that's creating the story or the artistry. Maybe the dancers don't need to know what they're dancing about but if they dance the steps then the audience will still understand the story. (Performer 4)

While the performers were familiar with this way of working and were comfortable with it, it was another factor which led to a lack of direct engagement with the interactive systems during the later part of the rehearsal period and during performances.

4.5.3 Separation Between Choreography and Interactive System

The fact that *Encoded* was the first work by Stalker Theatre which made use interactive systems, and that these systems were built specifically for this show, meant that a significant amount of time was spent by the director in setting up the technology, auditioning various settings and pre-sets and generally tweaking the system. This meant that where there would usually be one person acting as director/choreographer, a dedicated choreographer was brought in to work specifically on dance movements so the director had the time and capacity to maintain control of the overall work.

In the case of *Encoded* this led to a reduction in the amount of improvisation from the performers, as the development of the technical systems, under the supervision of the director, and the development of the choreography, under the supervision of the choreographer, were often occurring in parallel.

This is not to say that the choreography and interactive systems developed in isolation – in fact there were frequent sessions in which performers were able to play with the interactive systems, which resulted in further refinement of both the choreography and the systems themselves – but performers and choreographer acknowledged that the interaction was more limited than it could have been.

> So I think if we'd had a time, if we'd had time we could have done something more interactive… the wall didn't really drive us it just kind of decorated us, what we were doing. …I think we could have done a lot more with that but I think the time constraints [limited us].
>
> I looked at it [the interactive system] as another theatrical layer on top of what we were already doing. (Choreographer)

4.5.4 A Trajectory of Creative Development: From Improvisation to Composition

During earlier workshops, the separation between choreography and digital system was less apparent. In workshops and earlier performances, the performers were often working with much smaller scale projections – more in line with the size of

the human body. As the workshops became more focused on producing a final, polished work the emphasis shifted from playful, improvised interaction to a far more tightly choreographed performance with tightly controlled transitions between interactive and visual states.

> I enjoy the whole process but I definitely enjoyed the earlier stages, the play stages of where you really get to find ideas and really play with them… Towards the end when you just lock in things it's a bit tedious. (Performer 1)

The process for *Encoded*, probably typical of many creative projects, began with improvisations, which were reviewed and reflected upon, gradually codified and finally assembled into a final composition.

After initial improvisations and discussion took place, videos of performances were reviewed and successful elements were identified and usually given a name. The digital artists then saved successful states of the interactive systems into pre-sets with these names. The director and choreographer would refine the movements which seemed effective with those pre-sets. Finally, movement sets and interactive system pre-sets were arranged and assembled into the final show.

While some performers lamented the reduction in playful interaction which occurred in order to produce a polished work, there was also a sense that as the final choreography and interaction states became more familiar, the was scope for some of the early playfulness and connection with the interactive system to return.

> Then it flips and towards the end of the shows when you start embodying what you've made and really trying to find the connection with everything, it becomes fun again because you're finding your own creative path in the framework that's being built. (Performer 1)

4.6 Conclusions

The approach to practice-based research in live performance that has been outlined here attempts to maintain strong links between professional creative practice and research. In this kind of work there are a number of points where technology design and research can become separated from the concern of practitioners. A commitment to full creative partnerships, drawing on agile, iterative design approaches, is required to ensure that separation does not occur as a result of poor design. Research findings which result from unsuccessful collaborations can still be valuable, but it is unlikely that a badly designed interactive system will have a significant effect on the practice of performers, as they are likely to simply ignore it, or draw on the skills of their craft to work around its limitations.

In order to ensure that findings from research remain aligned with creative practice, we have found that careful observation and reflection, usually involving interviews and in-depth qualitative analysis, can result in findings which are grounded in the concerns of practitioners. The observations from the study of performers' experiences with *Encoded* shows how findings from these kinds of studies can provide insight into the relationships between interactive systems, performers and the broader creative process. These methods do not guarantee that research remains in tune with

practice, but the strategies of collaboration, iterative development, reflection and evaluation are all applied in order to ensure that the development of digital systems, their use in performance and the findings which result from careful examination of the impact they have on creative practice, remain aligned with the concerns of practicing artists.

References

Beck K (1999) Extreme programming explained: embrace change. Addison-Wesley, Reading

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

Candy L, Edmonds E (2002) Explorations in art and technology. Springer, London

Crabtree A (2003) Designing collaborative systems: a practical guide to ethnography. Springer, New York/Secaucus

Edmonds E, Candy L (2010) Relating theory, practice and evaluation in practitioner research. Leonardo 43(5):470–476

Frayling C (1993) Research in art and design. Royal College of Art, London

Glaser BG (1978) Theoretical sensitivity. The Sociology Press, Mill Valley

Glaser BG, Strauss AL (1967) The discovery of grounded theory: strategies for qualitative research. Aldine de Gruyter, New York

Jacob RJK, Girouard A, Hirshfield LM, Horn MS, Shaer O, Solovey ET, Zigelbaum J (2008) 'Reality-based interaction: a framework for post-WIMP interfaces'. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI '08). ACM, New York, pp 201–210

Johnston A (2011) Almost tangible musical interfaces. In: Candy L, Edmonds E (eds) Interacting: art, research and the creative practitioner. Libri, Oxfordshire, pp 211–224

Johnston A, Candy L, Edmonds E (2008) Designing and evaluating virtual musical instruments: facilitating conversational user interaction. Des Stud 29(6):556–571

Johnston A, Candy L, Edmonds E (2009) Designing for conversational interaction. In: Proceedings of New Interfaces for Musical Expression (NIME), Carnegie Mellon University, 3–6 June, Pittsburgh, PA, pp 25–48

Merton RK (1957) Social theory and social structure. Free Press, New York

Mogensen P (1992) Towards a provotyping approach in systems development. Scand J Inf Syst 4:31–53

Norman DA (2010) Natural user interfaces are not natural. Interactions 17(3):6–10

Paxton S (1975) Contact improvisation. Drama Rev 19(1):40–42

Schön DA (1983) The reflective practitioner: how professionals think in action. Basic Books, New York

Sengers P, Gaver B (2006) 'Staying open to interpretation: engaging multiple meanings in design and evaluation'. In: DIS '06: proceedings of the 6th conference on Designing Interactive Systems. ACM, New York, pp 99–108

Chapter 5
Interactive Art, Autonomy and Evaluation

Scott L. Simon

Abstract This chapter looks at interactivity and interactive art systems in relation to traditional aesthetic categories and artistic practice. Central to the chapter is an analysis of the tension between the autonomous artist and the interactive artist. Interactive art is theorized as belonging to a kind of practice which seeks to transcend, or at least refine, traditional categories such as autonomy. The author posits that the evaluation of interactive artworks must recognize the complex manner in which these artworks relate to the traditional social categories of art practice.

5.1 Introduction

Interactive art can be defined as a type of art that requires external participation in order to complete itself. The audience is an important element in the "interactive art system", a system that can be reoriented or affected by the input of external interaction on the part of the "audience". The traditional notion of an *audience* is questioned in an interactive art system insofar as the model of a passive attentive art consumer is replaced with a model that erodes the distinction between artist and consumer/audience.

In what follows I want to situate the practice of "interactivity" within a context that connects it to earlier categories of art production, in particular, the ideal of the autonomous creative artist. Although interactive art has, in some ways, progressed beyond the autonomous creator it is also a category that offers some important insights into current art practice. In Chap. 7 ("Intimate Aesthetics and Facilitated Interaction") by Loke and Khut (2014) we can see a type of practice that illustrates

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one form of interactivity. Their work embodies an aesthetic based upon the internal experience of a participant's body. The artist is seen as a facilitator who sets up experiences that will work upon the participants in a multitude of ways. The aim is to allow a reflection on internal processes to emerge. Furthermore it is the participant who expresses herself and not the artist. In Chap. 2 ("Human Computer Interaction, Experience and Art") by Edmonds (2014) the focus is also upon the participant. He raises various questions about the role of a participant and the experience of audiences in relation to artworks. Is the artwork the important factor or is it the experience? Is interpreting the artwork a performance in itself?

The questions that are raised by Edmonds (Chap. 2) and the manner of working outlined in the chapter by Loke and Khut (Chap. 7) share a common ground. Both papers represent a model of creativity that is to some extent outside of the ideal of the 'expressive' artist. The aim of the interactive artwork is to create a shared vision, a vision that can coalesce in some future reality. The model of the artist as privileged author is replaced with a different model. Bourriard describes this model: "intersubjectivity becomes the quintessence of artistic practice" (Bourriard 2002, p. 22).

It is noteworthy that within these new ways of understanding art practice there is a strong note of democracy. The completion of artworks comes through participation. The vision is a shared vision that is being built by everyone. The earlier model of a one-way street in which the artist hands down examples of beautiful self-expression is de-emphasized. However, the shadow of the expressive artist still appears in current artwork and the creative process. Art still registers a relationship to its past. That relationship is often one of conflict – many artists are not content to offer works that do not add anything to the earlier models of "self-expression". That said, such earlier models appear in new ways and in new configurations, entwined with e.g. philosophy or notions of inter-subjectivity. The continuing evolution of art is one in which nothing is certain or stable, and nothing disappears completely. The tension between different modes of working is not just an unfortunate fact, it is also, I would like to suggest, one of the ways that art progresses and stays vital. In what follows I would like to map out some of these tensions in relation to different artists. In the first section, I will look at some current interactive art, and in the second section the music of John Cage.

5.2 Interactive Art and the Artist

The development of a notion of "interactive art" is, on one level, an attempt to go beyond the historical categories of the artist as genius in the Romantic tradition and create a more "democratic" and functional mode of artistic praxis. This would seem, on the face of it, to be a progressive mode of operation. The category of "art" as a unity that is produced for passive reception can be, in some ways, a reproduction of one-sided and repressive relationships in which society sets up models in which power relationships move in only one direction. Interactive art can be understood – in an ideal schematic form – as a mode of praxis that allows many people to play a role

in the articulation and realization of aesthetic objects. Thus we bypass the twin poles of art as sacred religious ritual and the modernist version of the ersatz religion of the individual genius.

Interactivity, in a general sense, can be read as a linguistic signifier of a move towards a mode of production that de-emphasizes the genius or the ideal Romantic artist. The value of the word itself adheres to a tendency within art to speak a new language. It could then be situated within other discursive strategies of overcoming and realigning, strategies that we also recognize in constructs such as the "post-modern". Read in this way interactivity could in many ways be an open-ended idea that speaks not so much of what cannot be done under its rubric as to a differentiation of various practical strategies from earlier strategies. Thus we can read "interactivity" as a sign of differentiation, specifically the differentiation of a current praxis from an unrefined Romantic conception of autonomous creative subjects.

Traditionally art and music – in many forms – were connected to the sensuous element in religious ritual. It would not be correct to say that the only object of pre-modern music in western societies was a glorifying of God but it was certainly an important aspect of its *raison d'etre* (Weber 1977, p. 342). This applies also, broadly speaking, to painting and sculpture (Bürger 1984; Weber 1977).[1] Without rehearsing the different particulars of this relationship let us just point out here that the move to a modern autonomous *artist* who creates and expresses out of his (or her) individual soul is a change of perspective from the artist in the service of the religious ritual (cf. Bürger, pp. 15–34). Adorno describes this as the "freeing of art from its cultic function" (Adorno 1997, p. 1). The artwork becomes in this newer model – on one important level – the expression of individuality. Profoundly affective artistic experience now becomes the "ersatz for primary religious experience" (Weber 1977, p. 343) and art, formerly an ally of religion, becomes a "competing power" (p. 343). It is to be noted that this change of perspective does not remove art a great distance from its ritual and religious origins. The autonomous artist is now compared by some theorists and poets to a creative God who has the power to "transcend the natural laws" (Nahm 1947, p. 365; Browning cited in Nahm, p. 364).

Where does this "Godlike" creative power leave the audience of these artworks? The audience is in a passive and receptive position in relation to the consumption of art in this configuration. Roy Ascott stresses the difference between the passive and active reception of art: "Where once the function of art was to create an equilibrium, establish a harmony on the public level of relatively passive reception, art is now a more strident agent of change, jolting the whole human organism" (Ascott 2003, p. 111). And in relation to Poussin: "The paintings of Nicolas Poussin for example, wish to fix a set of relationships in the spectator's consciousness…he communicates, but by a one-way channel. The modern artist, on the other hand is primarily motivated to initiate a *dialogue*…" (p. 111).

We see in this formulation the difference between a *deterministic* art and a *behavioral* art (Ascott, as cited in Beryl Graham 1997, p. 40). Cornock and Edmonds

[1] This does not preclude the existence of music and art in the service of other heteronomous configurations such as courtly ritual etc.

label these two types *static* (declaratory statement) and *dynamic* (conversational model) (Cornock & Edmonds, as cited in Beryl Graham, p. 39). They further break the "dynamic" type into many different sub-routines. For our present purposes we will make use of only the main two types as this will allow us to situate and contextualize interactivity according to generalized aesthetic categories.

The interactive art system is a kind of practice in which categories such as 'individual creativity' and 'autonomous artist' become problematized. Just as in Happenings and other forms of participatory art (in the avant-garde) the emphasis on creativity shifts to the ideal of a conversation. Art that seeks to create a conversation that approaches the kind of conversation that two people might have is the normative standard for such interactive art (Beryl Graham 1997, p. 42). This shift towards a dynamic model is not just a critical engagement with reception it is a critical engagement with the idea of the Godlike creator – the spiritual vehicle is now formed around a dialogue and not a sermon.

Theorist Frank Popper has a broader model of techno-creativity that he names "virtual art" and which can be understood as a going beyond the standard paradigms of creativity towards an emphasis upon the cognitive, synaesthetic and sensory immersive possibilities in creative practice, and he notes that one of the most important elements of such works is their "openness to reciprocal creative action" (Popper 2004).

A lot depends upon the form of each individual interactive art system; some will be invested more in the creative artist some invested more in the democratic and open form "art system". Look for example at the interactive artwork *Staalhemel* (2010) by Christoph De Boeck. Brainwave patterns are picked up by an EEG and used to drive steel pins in a steel matrix located above the gallery floor. Individual brainwave patterns and activity create unique rhythms and can be controlled (to some extent) by focus and relaxation. Certainly in a work such as this the audience has become a part of the landscape and the interaction between audience and installation completes the work. Such art can perhaps lead beyond the simply immersive to configurations in which the audience is involved with every aspect of the art form. This would lead to a change in the basic dynamics of art appreciation and creation. Indeed when one witnesses the social interaction that takes place while engaging with *Staalhemel* it is obvious that the traditional modes of evaluation do not apply – the work is successful outside of ideals such as 'beauty'. The type of interaction I am referencing here relates to the manner in which technology can form a shared network (within the gallery) in which communication and intersubjective relations are facilitated.

Does interactive art share a radical agenda with the historical avant-garde? Certainly the potential is there. Happenings were a kind of breakdown or rupture of the distinction between artist and audience and this could be understood as connecting such forms to interactivity. Söke Dinkla however notes that the types of participation in the two forms are quite different: the interactive art-form is based around "meeting the needs of a media educated public" (Dinkla 1994, p. 1). He does also acknowledge that the role of the artist has changed in both forms – the artist is no longer located "outside" society as an external commentator (p. 1).

The avant-garde involves itself with a tension in connection with past categories of praxis that is relevant here. When Duchamp "creates" a readymade his targets are (1) the category of the creative personality and (2) the concept of artistic genius. The undermining of obvious gestural connection to artistic virtuosity is deconstructed.

Although interactive art changes the role of the audience the *artist* as creative force is in some form retained. What we actually see in interactive practice is a dialectical engagement with art as a spiritual vehicle. In evaluating interactive art we must take into account this dialectical nature. Interactive art moves beyond an unsophisticated connection to the categories of the past yet it still maintains some of the key elements of that past. If we look at a work such as the *Lotus Dome* (2010) of Studio Roosegaarde many of the key aesthetic categories of natural beauty are retained – albeit in a mutated technological form. In the case of *Lotus Dome* we are offered a "futuristic vision of the Renaissance" (Studio Roosegaarde 2013, p. 1). Interactively the work responds to the proximity of the audience making tiny foil flowers furl and unfurl; light and ambience change with the movement and behavior of the audience. The artifact is a kind of living breathing entity that brings to life the surrounding architectural structures and spaces. Here we can see that a spiritual element is emphasized through technology even as the location of that element shifts.[2] Artworks such as this utilize interactive components but they evolve harmoniously out of a lineage (in this case an idea of the Renaissance). There does remain some tension within such pieces; the creative power of technology to shape the world appears prominently within such works. A modern audience interacts primarily with this shaping element and less with the idea of a transcendent deity.

If we look at a work such as *Magic Eye* (Sommerer and Mingoneau 2010) it brings another type of interactivity into play. In *Magic Eye* one inhabits a philosophical space in a way that allows a bodily engagement on the part of the audience – this is not the same as a complete conversation but that is not the goal of such works. The form of the artwork allows physical activity (play) to take place within a space that represents a philosophically engaging idea mixed with humor. It should not be forgotten that a conversation based upon superficialities is largely uninteresting – the artist must still bring an idea to the table.

While interactive art inhabits the space between artist and audience it does not attempt to destroy the distinction. For the artists that we have mentioned individual creativity and philosophy are still aspects of the art-making process. Individual creativity in the form of "genius" is not an ideal that is neurotically emphasized by participatory forms of art, yet individual creativity and personality are elements that are nevertheless retained in some form within the artworks. This dialectic is indicative of the manner in which some art relates to its past – a relationship of tension and conflict with the theoretical foundations of the past. It is clear also that the scope and focus of the tensions within individual artworks vary widely from artist to artist. One can see this conflict clearly in *Lotus Dome*. The work is a "techno church" (situated within an actual church) in which technology becomes the

[2] Indeed in a press release the studio describes the work – situated within in a church in Lille – as a "techno-church".

animating spiritual force. The work sits amongst the earlier examples of Renaissance art in a slightly uneasy truce – is this a friend or foe this new God?

In the following section I will look at experimental music practice. This will enlarge our understanding of how different functional elements are woven into the way some types of art engage with past art theoretical categories.

5.3 Music and Form

In this section I am going to shift the focus across to music and the tensions that music composition inhabits in regard to past aesthetic categories. This will enlarge our understanding of the dialectic at work in interactive art. I will focus upon experimental music (John Cage).

Weber's *Religious Rejections* piece concerning the aesthetic sphere refines the meaning of the concept "autonomy" as it relates to artistic praxis (Weber 1977, pp. 341–343), and his work provides a zero point for the analyses that follow. In that piece Weber shows that religion is antagonistic towards the "this-worldly" salvation of musical experience. Music is a "competing power" that can excite many of the effects of religious experience but without any connection to other-worldly salvation. The end result of this dynamic is that the artist is expressing her "innermost self" and in the process freeing her mind and body from coercion by ethical norms. A side effect of this is that the artist becomes the locus of power.

Eduardo De La Fuente's work offers an analysis of the modern artistic persona in Weberian terms as mystic/priest/prophet/ascetic. One of the chapters in his work on twentieth century music deals with John Cage as an artistic persona. In that chapter he emphasizes the idea of Cage as the "composer as mystic" (De la Fuente 2011, p. 126). His analysis is mainly concerned with this category of "type" but he briefly touches upon the dialectic between spiritual concerns and de-structuring impulses within the art object. We can see hints of this in a quote from Susan Sontag (cited in De la Fuente, p. 132) in which the paradoxes between the new forms of "anti-art" and art as a "spiritual project" are introduced. Sontag writes in relation to reinventing the project of spirituality in the modern era:…"art must tend towards anti-art" (Sontag 1972, p. 51). I would like to focus upon and develop this paradox. This "paradox" seems to me to extend our understanding of Weber's position. The ideal of the autonomous artist is one in which a religious dimension is retained (the artist as expressive locus). Anti-art pushes the development of art away from this ideal. Anti-art seeks to substitute chance for intention, to eliminate the subject and find the silence beyond speech (Sontag 1972, p. 51). There is a conflict of models here that can also be read in Cage.

John Cage's *Lecture on Nothing* contains this phrase: "I have nothing to say and I am saying it and that is poetry as I need it" (Cage 2011, p. 109). The quote contains, to my mind, precisely the kind of imagery that the artist of the modern era is required to absorb. Certainly Cage was not entirely coherent in such quotes.

He was an ardent proponent and student of Zen. Thus his "silence" or his "nothing to say" must also be read in this spiritual context. The "nothing" in "I have nothing to say" can be read as the *silence* at the heart of the Zen mystic. If we are looking for an artist who wishes to de-structure musical form Cage fits the bill. We can also see in Cage an attempt to de-structure traditional notions of music as the vehicle of expression for creative subjects. His work is rhetorically tied to the liberation of tone from external expressive elements. Yet there remains a spiritual dimension to his work. The "silence" is connected to a vehicle that is still religious in design, and within the radical gestures there remains the seductive call of the art and the artist – the call to travel along with. This call is of course the same call as the sacred tones of religion and ritual in a more refined and attenuated sense. However it is important to perceive that there is a dialectic at work in Cage. The silence of 4'33 is an attempt to create an awareness of the self within the audience, the de-centering of the creative focus. This can be seen as a direct engagement with and attack upon the unsophisticated use of music as ersatz religion. In this way there is a dialectic between spiritual vehicle – the call – and a more radical attack upon this vehicle – the splintering of the call into many individual moments. It is rightly perceived that this is an interactive moment in the work of Cage – an interaction in the form of a move beyond the traditional artist/creator to a more open-ended conception (Edmonds 2011, p. 21). It is precisely this dialectic between (1) the spiritual/religious/autonomous artist, and (2) the de-centered (anti) artist, that is central here.

Art becomes in Weber's formulation an aesthetic sphere with its own rationality. It competes in the modern era with organized religion – the power of the expressive artist becomes the locus. But this expressive subject, autonomous and sovereign, becomes a target for the "anti-artist". Anti-art seeks to complete the disenchantment of art. Yet in Cage's piece 4'33 anti-art (as silence) is entwined with spirituality and mystical ideals – seemingly antagonistic components.

There is a conflict between the philosophy that seeks to dis-enchant the world and the artists that create new worlds and vistas, new vehicles for people to fuse with in temporal unfolding. As Weber pointed out music is a kind of Ersatz religion, a powerful tool that – originally allied with religion – comes in the modern era to be in competition with it (Weber 1977, p. 343). Other institutions can and do take hold of this tool. Music seeks followers to its various causes: the modern man, the creative genius, the technological utopia. Or more cynically music seeks corporate credibility for sanctioned versions of the "genius" and "utopia" – words that recede into a new configuration of cynical profit making and exploitation. Within the new "religions" of Enlightenment and Industry music is a tool which is used to provide credibility and confidence. Music which registers this cynical use of its affective power forms itself into anti-art and atonality. Adorno states famously that: "the only works of art that really count are those that are no longer works at all" (Adorno 2002, p. 30). He goes on to champion the de-structuring of tonality as the only possible move in a society that is based upon repression and alienation (Fubini 1990, p. 443). We must point out here that even within the most de-structured and atonal forms of music there are still some elements of unity that seek to gain acceptance from

the audience – only no music at all is without this core.[3] De-structuring form will not necessarily deconstruct power relations.

Cage does not feel the need to completely embrace anti-art and de-structuring elements – he works with such ideas in a playful manner retaining other elements within his work. Looking at our description of Cage's activity we see that the critical attacks upon musical form – embodied in atonal works and more radically in 4'33 – are elements that exist within a relationship to Zen and spiritual concerns. This dialectic between the spiritual and the destructive is at the heart of a work like 4'33. Cage makes an anti-art gesture with his silent composition, but the silence is paradoxical: it contains a call to travel along with the Zen mystic. On the one hand silence is about as radical a de-structuring of form and authorship that is possible, on the other hand Cage re-introduces a spiritual call. Importantly the call is formed as a relational moment; Cage works *with* the audience to bring the call in without coercion. That at least is the *gesture*. Such gestures show audiences that the artist understands the issues in a complete and dialectical way. Cage refuses to use the power of music to seduce the audience onto the Zen path – he gently brings the spiritual element in via an interactive moment (the ego basis of self-expression is bypassed). Understanding the tensions in the theoretical foundations of practice allows an artist like Cage to create a space within which audience consciousness can express itself freely. Without such an understanding some audiences might register the unexamined (non-theorized) forces within a work as components that create distance and alienation.

The lines that connect the concepts of artist and anti-artist are complex and dialectical; such configurations cannot be reduced to simple formulations. We showed above that some music (with Cage as an example) inhabits these sites of conflict. In Sect. 5.2 we traced an analogous conflict in relation to interactive art. The thread that joins both of these analyses (Sects. 5.2 and 5.3) lies in the exposing of the manner in which the models and paradigms of the past become sites of conflict and tension. Not content with earlier paradigms (but unable to escape from them) some art proceeds by attempting to free itself from within – haunting the earlier models. The space of tension realized in music by inhabiting the area between art and anti-art is analogous to interactive art inhabiting the space between artist and audience. These tensions and conflicts result in the refinement and evolution of the philosophical foundations of praxis. There is no attempt to shatter earlier paradigms by artists. It is rather the sophisticated engagement with these paradigms that keeps art alive. When evaluating art – be it interactive art or avant-garde music – we must register these relationships. The manner in which progressive art skirts boundaries or inhabits liminal spaces is central to its evolution.

The evaluation of interactive art includes within its domain the gesture of exteriority, i.e., interactivities attempt to move into new areas beyond the scope of traditional aesthetic categories. This move cannot be said to actually leave behind categories such as the autonomous subject or the "creative personality". However when we

[3] Adorno did acknowledge this position, citing Stockhausen as its source, in his essay from 1961 *Vers une musique informelle* (Adorno 1992, p. 276).

read this move in a certain way it allows us to perceive a shift in the self, understanding of the artist. This shift does amount to actual differences in creative production and artistic trajectory.

For the practising artist the theorizing of one's work allows for the development of an art that does not repeat the past. If the artist leaves "obvious" concepts such as *creativity* or even *artwork* unexamined the works that are produced will lack sophistication within the theoretical dimension. This is not a concern for artists who work intuitively but for artists that deal with communication and inter-subjective relations this theoretical sophistication would seem to be required. As the "audience" becomes part of artworks they, in turn, must ask more questions of these works. As art shifts into new modes of working, new forces come into play: the point of interaction is a place from which almost anything can emerge. As participants of interactive works enter into such a space, they might ask themselves: "what is this space? What kind of theories and ideals are being worked with? What kind of theories and ideals are being reacted against? Does this space understand itself completely or are other hidden forces marked out within it?" The evaluation that would take place in the presence of such artworks would focus on whether the works were capable of creating room for interaction outside of a sanctioned field. The questions that would need to be answered here would be:

Does an artwork create new theoretical models which allow consciousness to express itself freely?
Does it foster networks that transcend prejudice?
Does the artwork allow engagement outside of the sanctioned corporate system of engagement which has vested interests in producing capital (and securing the future production of capital)?

For the participant in the continuing evolution of art forms the critical force and ideological resolution of the works must play a part in the evaluation of their experience. If art is merely for entertainment then such ideas are irrelevant. If art has some deeper significance in relation to the evolution of mind and spirit then such questions will necessarily impose themselves.

5.4 Conclusions: Concerning Methodology

I would like to conclude with a brief note on method and methodology in relation to the kind of working modes outlined above. In some ways what I have documented above clarifies the theoretical elements that exist within every art practice. Art has always had a connection to theory whether it be in the form of an idea such as "beauty" or a complete system of signs in relation to the sacred. Yet the connection has often been an uneasy truce. Artist's are often seen as "intuitive" and outside the vulgar reductions of discourse. Avant-garde art and conceptual art are exceptions to this insofar as the philosophical element is emphasized within the structure of the art itself.

That said we must acknowledge that all artists work with some conceptual tools – art practice presupposes a concept of "art". Historical currents and personal approaches refine and reshape the basic philosophical and conceptual foundations of art practice. An art that is philosophical or theoretical is an art in which the connections are understood in a complete way and manipulated as part of the process. For the working artist this involves the intersection of practice-based work with theoretical understanding. This convergence is part of the university based model of artistic practice. The ideal of cross-disciplinary work and the importance of discourse in the research environment point to a strong connection between theory and practice. Art theorizes itself as belonging to some mode of operation and it is important for artist's to understand themselves in this regard. The more completely one understands the theoretical currents, the easier it is for the artist to work in a manner that is coherently structured around ideas. A more hit and miss approach is also a part of art making. For artists today the "intuitive" approach looks less and less appealing as a master key: art is now increasingly connected to inter-subjective relations and connections and clarity and communication are important. On the other hand, the intuitive approach allows the artist to move into space that would otherwise be closed off.

The methodology that is proposed here is one in which the refinement of theory provides new incentives to create without boundaries. To treat categories such as "art" or "beauty" as networks that can be defined and manipulated according to specific goals allows the artist to work playfully within these categories. I provided some analyses of the manner in which some art moves around within different philosophical categories (for example Cage's work shifting between the spiritual and destructive via the interactive). The desired result of this chapter is to focus the artist's perception on these theoretical and philosophical connections. This focus on an often tacit element in working practice can lead to artworks and methods of working that are more theorized.

The role of the artist is not fixed immutably – the foundations of the past do not vanish but neither are they the law. The method of working that interprets the created artifact in the light of theory can lead to new elaborations and iterations that transform the artist's knowledge base. This method is one that the present author finds very useful in his own practice. The working with theory as a fluid and mutable element within the creative process allows one to escape any rigid models or pre-defined modes of operation. Different philosophical approaches and different aesthetic theories can be fused within the same artwork – arguments can be played out and tensions mapped. Theory and philosophy inhabit one level of the artistic plane, and the development and refinement of their use can become an important aspect of practice-based research.

References

Adorno TW (1992) Quasi una fantasia (trans: Livingstone R). Verso, London/New York
Adorno TW (1997) Aesthetic theory (trans: Kentor RH). Continuum, London/New York
Adorno TW (2002) Philosophy of modern music. Continuum, New York

Ascott R (2003) Telematic embrace: visionary theories of art, technology, and consciousness. University of California Press, Berkeley/Los Angeles
Beryl-Graham CE (1997) A study of audience relationships with interactive computer-based visual artworks in gallery settings, through observation, art practice, and curation. PhD Thesis, Sunderland University, Sunderland
Bourriard N (2002) Relational aesthetics. Les presses du réel, Paris
Bürger P (1984) Theory of the avant-garde. University of Minnesota Press, Minneapolis
Cage J (2011) Silence. Wesleyan University Press, Middletown
De Boeck C (2010) Staalhemel. Interactive artwork, Theater Op de Markt
De la Fuente E (2011) Twentieth century music and the question of modernity. Routledge, London
Dinkla S (1994) The history of the interface in interactive art. In: Proceedings of the 1994 International Symposium on Electronic Art (ISEA). http://www.kenfeingold.com/dinkla_history.html. Viewed 16 Aug 2013
Edmonds E (2011) Interactive art. In: Edmonds E, Candy L (eds) Interacting. Libri, Oxfordshire, pp 18–32
Edmonds E (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23
Fubini E (1990) History of music aesthetics. Macmillan, London
Loke L, Khut G (2014) Intimate aesthetics and facilitated interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 91–108
Nahm MC (1947) The theological background of the theory of the artist as creator. J Hist Ideas 8(3):363–372
Popper F (2004) Origins of virtualism: an interview with Frank Popper conducted by Joseph Nechvatal. CAA Art J 63(1):62–77
Sommerer C, Mignonneau L (2010) Magic eye, interactive artwork, MNBA National Museum of Fine Arts, Santiago
Sontag S (1972) The aesthetics of silence. In: Sears S, Lord GW (eds) The discontinuous universe; selected writings in contemporary consciousness. Basic Books, New York, pp 50–75
Studio Roosegaarde (2010) Lotus dome, Interactive artwork, Sainte Marie Madeline Church, Lille
Studio Roosegaarde (2013) Press release lotus dome. http://www.studioroosegaarde.net/uploads/files/2013/01/23/158/Pressrelease Lotus Dome Daan Roosegaarde.pdf. Viewed 16 Aug 2013
Weber M (1977) Religious rejections of the world and their directions. In: Gerth HH, Mills CW (eds) From Max Weber: essays in sociology. Routledge and Kegan Paul, London, pp 323–359

Chapter 6
The Machine as Autonomous Performer

Oliver Bown, Petra Gemeinboeck, and Rob Saunders

Abstract In this chapter we explore the experience of interactive system-based artworks that exhibit autonomous behaviours in an interactive context. Engaging with such autonomously behaving works opens up experiences that are more akin to conversing, performing, or negotiating. We introduce cybernetic influences and take a closer look at the performance of the participant/machine system. Following this, we discuss the ways in which artists approach working with adaptive systems and observe audiences to iteratively improve their system designs. At the core of the chapter is a discussion of five artworks that serve as our case studies: two influential works: Edward Ihnatowicz's *The Senster* and Ken Rinaldo's *Autopoiesis*, and three projects developed by the authors: *Uzume*, *Accomplice* and *Zamyatin*. We use these case studies to explore the artists' approach to autonomy, how it shapes the audience's experience and the methods used in the development and evaluative process.

6.1 Introduction

Distinctions between the dynamic and autonomous behaviours of the natural world and the static and controllable properties of the built environment are disintegrating. Artists have long attempted to enrich our experiences with the enchanted and magically animated, and, in this context, have also experimented with concepts from

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cybernetics, Artificial Intelligence (AI), and Artificial Life (ALife). In this chapter, we will discuss system-based artworks that exhibit autonomous behaviours, and what may appear to be intentions, independently of being 'activated' by a human participant.

Interactive artworks that behave or perform autonomously challenge the most common interaction paradigm of reacting to what is sensed according to a pre-mapped narrative. Engaging with autonomous works opens up new experiences that are more akin to conversing, performing, or negotiating with something that has its own awareness. Our exploration concerning the evaluation of these works focuses on the ways in which artists approach autonomy and the methods and criteria they develop to achieve autonomous behaviours. This is evaluation of a qualitative nature, leading to questions such as: how does the system behave, how does it involve the participant(s), and in what ways does this 'dialogue' or co-performance differ from interactive experiences with non-autonomous artworks?

6.2 The Art of Behaviours

We can distinguish different types of interactive artworks on the basis of the work's or the system's complexity and how it relates to its interactive capacity. A simple or weak form of interactivity can be achieved whenever any kind of input is provided to a system, e.g., a button press. In most cases, this simple input creates a singular, linear link between the 'interactor' and the system. In contrast to this, we can sketch the outline of an interactive system exhibiting some form of autonomous behaviour, and is likely to produce a more complex form of interaction between a person and the system.[1] For some, the distinction underlies the very meaning of the term 'interactivity'. As Ruairi Glynn, creator of the adaptive work *Performative Ecologies*, states, "the widespread misuse of the term 'interactivity', has trivialised its meaning to the point that it holds no more conceptual value than reactivity to most of today's artists, architects and designers" (Glynn 2008: 1).

For Usman Haque, the failure of much interactive art and architecture lies in its inability to enter into a conversation with a person. In Haque's view a typical interactive work "invokes a mutually reactive relationship only slightly more sophisticated than that between a person and an automated cash machine." (Haque 2007: 26). Whilst the continued novelty of digital computing technologies has allowed simple interactive systems to flourish, more complex interactive relationships remain challenging to creative practitioners and their audiences.

The re-emergence of certain strains of cybernetic thinking, in the form of ALife in the 1990s, opened up the possibility for a transformative creative development in

[1] Such complexity, for example, may be captured by the formalisation of digital art systems by Cornock and Edmonds (1973), including the category 'dynamic interactive (varying)' in which the conditions of interaction change over time. The works described here are most likely to fit this category, but may achieve a complexity of interaction by other means than devising mechanisms for long-term variation.

which artefacts might transcend their status as mere objects. Artists producing such behavioural artefacts have often been inspired by the interdisciplinary experimentation that occurred in cybernetic explorations (Boden and Edmonds 2009). At the core of this influence of cybernetic thinking is the idea of looking at artworks as systems and systems as artworks. This can be seen in relation to different strands of thinking at the time: on the one hand, drawing inspiration from the growing awareness of the diversity of dynamics exhibited by systems in the natural world, and, on the other, a cybernetic influence cutting across all of modern art (Ascott 2002).

In more complex approaches to interactivity, the system is addressed "as quasi-organism, in autopoietic or enactive sensorimotor loops with user(s)" (Penny 2011: 80). Autopoiesis, applied to aesthetics, can be understood as a self-propelling system of aesthetics that is open to negotiation (Hall 2010). An interactive system as such expands or completely evades the bi-directional input-process-output modalities of many interactive systems. Rather, participants are more likely to engage with the work in ways akin to encountering another life form or inhabiting an alternative world. No matter how strange the artificial creature or world we encounter may be, we are already in our element as 'interactors', and don't need to learn a new language or interaction paradigm. As Penny observes, our ability to interact with digital systems is rooted in our evolved adaptation to embodied experiences in the world:

> We are first and foremost, embodied beings whose sensorimotor acuities have formed around interactions with humans, other living and non-living entities, materiality and gravity. We understand digital environments on the basis of extrapolations upon such bodily experience-based prediction. (Penny 2011: 78)

Inherent to such systems is their performative nature, which goes beyond the fact that there is action involved. If systems are to act autonomously then their actions clearly cannot be staged; only in their real-time enactment can we know what they do. This performance necessarily unfolds in the present, without the certainty afforded by rehearsal. Participants or 'interactors' are "caught up in a direct experience of the work's dynamics" (Tenhaaf 2008: 12). We can say that both the participant and the system become performers in this process.

In embracing this performative potential of machine agents, artists have striven to shift the focus from representational issues to questions of agency and relationality. This leads to works that are not artefacts to interact with but rather, in the words of Nathaniel Stern, "relations to be performed" (2011: 233). The work is continuously constructed and composed, more akin to an event or a performance than a fixed interface or installation. An analytical approach to investigating the experience of, with, or within these interactive works is therefore best achieved by focusing on the performance of the participant/machine system, and its performative capacities.

The above provides a cursory overview of the intent and thinking behind a cybernetics-inspired approach to art making. In the following we introduce ways of asking about autonomy, as a means to gain insight into a system's behaviour and how it relates to its aesthetic performance.

6.3 Approaches to Autonomy

The evaluation of a performative experience that does not reveal itself except through interaction is central to the conceptual approaches outlined throughout this book, in particular Chap. 3 ("Evaluation and Experience in Art") by Candy (2014). Our focus is on the means by which artists, and audiences, conceptualise and realise interactions with systems that exhibit autonomy. We see the qualitative, and often anthropomorphizing categorisation of behaviour as key to evaluating both the creative and the experiential process.

Anthropomorphism helps us to predict behaviours, to engage in them, as well as to maintain our interest (Horowitz and Bekoff 2007). For instance, encountering an autonomous work or system, we tend to apply anthropomorphic terms to categorise behaviour: we may ask, is it 'alive', 'aware', 'curious'? Does it have 'intent'? Perhaps we even wonder if it is 'playful', 'mischievous', or 'stubborn'? Does it matter what I do and how I do it? A pivotal question for evaluating an autonomous work is: what are the perceptual or conceptual cues and rationalisations that lead people to make such judgements?

As an entry point to building autonomous systems, some artists draw on scientific theories and models, which offer a formal basis for approaching autonomy. For example, Seth (2010) has operationalized autonomy as a measure of *self-determination* in an analysis based on the predictability of systems in terms of different causal factors. If a system's behaviour can be predicted entirely on the basis of its external environment then it is said to be heteronomous. In contrast, we can find evidence of a system's autonomy if its own history is required to predict future behaviour. This approach to autonomy connects systematically with other key concepts such as causality and complexity of behaviour, via the mechanics of predictability.

We will take a closer look at the artists' motivation and audiences' perception in our case studies later. As several of the chapters in this book discuss, a necessary part of the process of developing interactive works is to investigate, anticipate or otherwise understand audience behaviour. In the artworks included here, evaluation is informal, but nevertheless involves identifiable methods. It typically involves prolonged observation and probing of the system itself, which can take a more systematic approach in terms of searching the parameter space of a computational system, setting up test cases or specific studies to develop the mappings for interaction, and an analysis of behavioural properties. The artist typically spends long periods observing the system's behaviour under different circumstances. Since the systems are behaviour generators, this often requires extended periods of waiting and watching as different behaviours are revealed. Exactly what is being sought in this process may be hard to define for the artist. Given the meta-creative nature of the process the artist must develop an understanding of the range of possible behaviours, and the nature of their distribution. In this way, whilst interaction with an audience will be different from that observed in the studio, the artist is able to anticipate the likely system behaviour in the exhibition context.

A further stage of evaluation involves participatory observation, which are often integrated into a process of tinkering to improve the work as it is iteratively adapted for a presentation context, site–specific setting, and in certain cases professional performers. A categorisation and discursive analysis of both system and participant behaviour is a critical part of this evaluation process. This may be informal and forms part of the artist's discourse surrounding the work.

6.4 Interacting with Autonomous Agents – Five Case Studies

To address our core question of how artists and audiences approach autonomy as an aesthetic and experiential concept, the following invites the reader to engage with the questions we raised above more tangibly – from inside the artworks themselves. We discuss two pioneering artworks, as well as three of our own artworks, as we can offer an intimate working knowledge of those. This selection of works is not definitive in any respect; there are a great number of significant interactive systems that could also be included here, such as Penny's *Petit Mal* (Penny 2009), Glynn's *Performative Ecologies* (Glynn 2008) or McCormack's *Eden* (McCormack 2001).

6.4.1 The Senster, by Edward Ihnatowicz (1970)

Edward Ihnatowicz's interest in developing kinetic sculptures stemmed from his conviction that the behaviour of something tells us far more about it than its appearance. *The Senster* (Fig. 6.1) is celebrated for its originality and the notable effect it had on people who experienced it. It was Ihnatowicz's largest and most ambitious work: standing 2.5 m high 'at the shoulder', the body of *The Senster* was constructed from tubular steel, with no attempt to disguise its mechanical nature. The long articulated neck of *The Senster* contained six hydraulically operated joints and two additional actuated joints in the head allowed it to be positioned much more quickly than the rest of the neck. Four microphones and two Doppler radar units were mounted on the head. The radar units were used to detect motions of visitors. The microphones were arranged in two pairs—one horizontal and the other vertical—allowing sound to be localised by cross–correlating the inputs on each pair of microphones. A Philips P9201 digital computer, with 8 Kb of core memory, was used to control *The Senster* according to programs loaded from punched paper tape. The 16-bit servo control output of the computer was fed into racks of custom electronics that provided the interface to *The Senster*. At the heart of this interface was the *predictor*, which smoothed the output voltages so that they followed spline-like curves and made the movement of *The Senster* look natural.

As an example of behaviour–based robotics, *The Senster* was two decades ahead of its time. Using an approach that came to dominate robotics research from the late 1980s onwards, *The Senster* implemented a small set of simple behaviours that

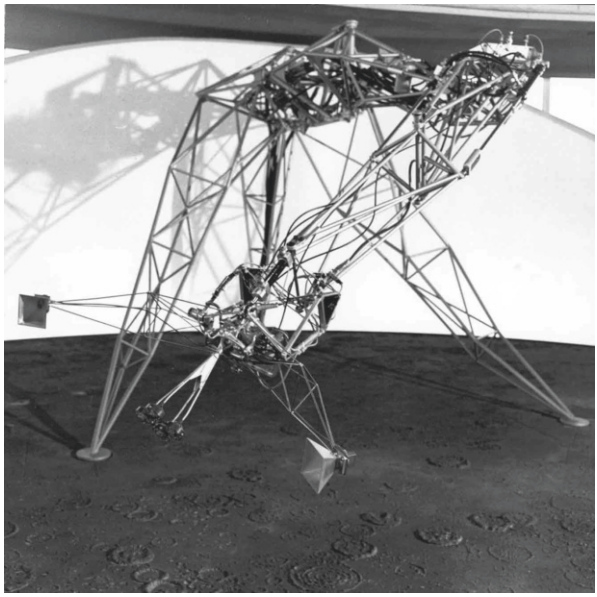

Fig. 6.1 Senster on display at the Philips Evoluon, Eindhoven, 1970–1974 (© Edward Ihnatowicz, courtesy of Olga Inhatowicz)

combined to produce seemingly more complex ones. Upon detecting a sound, *The Senster* would quickly turn its head in the direction of the source, with a speed proportional to the volume of the sound. If the direction of the source remained constant for some time, the rest of the body would slowly 'home in' on the sound in stages. Sudden movements detected by the radar units, would 'frighten' *The Senster*, causing it to withdraw. Likewise, loud noises would make it shy away from the source and if the general sound level became too loud, *The Senster* would rise up and "disdainfully ignore further sounds until the volume subsided." (Zivanovic 2005: 104).

When installed at Eindhoven, Ihnatowicz remained for 3 months after *The Senster* was unveiled at the Evoluon, spending much of his time in the exhibition, reprogramming *The Senster* and observing its interactions with audiences. The unpredictable behaviour of the audience, combined with the acoustic dynamics of the hall, apparently made *The Senster*'s behaviour seem more sophisticated than it actually was. In his own words, Ihnatowicz stated, "[p]eople seemed very willing to imbue it with some form of animal-like intelligence and the general atmosphere around it was very much like that in the zoo" (Ihnatowicz 1988: 6).

Ihnatowicz was disconcerted by his observation that people would refer to it as intelligent because "there wasn't an iota of intelligence in it: it was a completely pre-programmed responding system" (Reffin Smith 1984: 149). After his return to London, Ihnatowicz started to engage with artificial intelligence research, partly because, knowing how simple *The Senster*'s control software was, he "felt like a fraud and resolved that any future monster of mine would be more genuinely intelligent" (Ihnatowicz 1988: 6).

From the accounts we have of *The Senster* it is clear that Ihnatowicz was keenly interested in evaluating the nature of the interaction between his creation and audiences. One of Ihnatowicz's most interesting observations was the effect that the appearance of controlled movement and response to the environment had on audiences:

> When [Ihnatowicz] was testing [The Senster] he gave it various random patterns of motion to go through. Children who saw it operating in this mode found it very frightening, but no one was ever frightened when it was working in the museum with its proper software, responding to sounds and movement. (Michie and Johnston 1984: 153)

The difference in the observed reaction of audiences to *The Senster* moving randomly versus moving in response to environmental stimuli is entirely understandable, given Penny's observation about the embodied nature of our expectations: truly unpredictable movement is almost always a sign of something dangerous to be around. The secret as to why people were so willing to ascribe autonomy to *The Senster* may have been that, through careful observation and calibration of the work within it's complex environment, Ihnatowicz was able to strike just the right balance between unpredictability and responsiveness in its interactions with audiences.

6.4.2 Autopoiesis, by Ken Rinaldo (2000)

Ken Rinaldo's interactive installation *Autopoiesis* consists of 15 articulated robotic arms suspended from the ceiling (Whitelaw 2004). Each arm is made from multiple lengths of untreated grapevine connected together by four plastic joints and held in tension with steel wire. The arms are 3 metres in length and tapered towards a tip. Mounted at the top of each arm is the control unit, housing a microcomputer and an array of sensors, three infrared proximity sensors to detect the presence of visitors and an array or four microphones to localise sounds. At the tip of each arm is an additional infrared sensor, which is used to probe the environment, and a microphone used to sense telephone touch-tones emitted by each arm.

A microcontroller in each arm implements "a collection of co-operating real-time processes" (Rinaldo 1998: 407) that interact to produce the machine's performance. For example, simple reactive behaviours, such as using the infrared sensors to avoid collisions with audience members as they walk around, combine with others, such as moving towards the source of sounds but recoiling if the sound is too loud, to produce the ongoing behaviours of each robotic arm. The arms use telephone touch-tones to communicate between themselves, signalling the positions of detected audience members. Upon hearing these signals, they will move towards the position given, and it is this audible communication that allows the arms to coordinate their global behaviour.

In many ways, *Autopoiesis* can be considered as a single, independent entity, sensing and responding via its network of limbs. When an audience member enters this system, they together "make a second order autopoietic system that activates

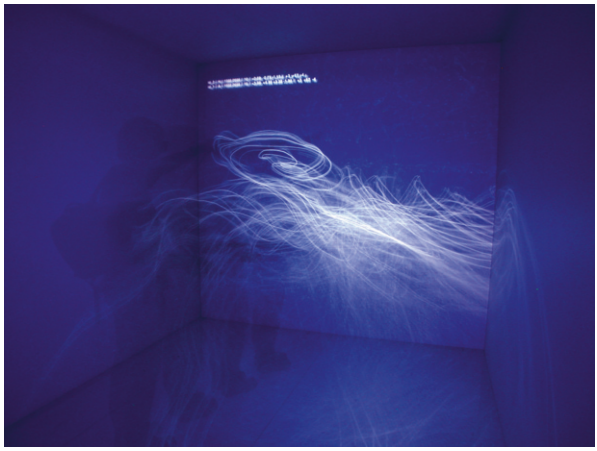

Fig. 6.2 Uzume, immersive virtual environment, 2003 (© Petra Gemeinboeck. Photograph by Victor S. Brigola)

through a highly complex negotiated system of organized functioning of its parts" (Hall 2010: 2). As audience members move through the installation the arms move their tips toward them without ever touching them. When a person is present between the arms, the behaviour of the sculptures is more agitated, complex and probing. When the audience observes from the outside, the installation falls into a more serene state of 'waiting'. At the tip of two of the arms, cameras capture the scene, which is projected onto the walls of the gallery space, giving audiences a sense of being observed as much as of observing (Tenhaaf 2008: 13).

Autopoiesis is a clear example of a work that has been strongly influenced by formal theories of autonomy, explicitly referencing the 'self–making' property of all living things first described as 'autopoiesis' by Francisco Varela and Humberto Maturana. The work *Autopoiesis* produces a system that both "functions as an autonomous entity, made of both the biological and mechanical parts, and as an operationally open 'life form', when coupled with its phenomenological environment through interactivity" (Hall 2010: 3). The 'organic', autopoietic mechanisms, bring to the fore the interdependence of this machine, as well as how its evolution is closely coupled with the audience and the environment. The work conceptualises, implements and exhibits autonomy through the system's adaptive properties, pertinent group behaviour and long-term change.

6.4.3 Uzume, by Petra Gemeinboeck, Roland Blach and Composer Nicolaj Kirisits (2000–2003)

In *Uzume* (Fig. 6.2), an abstract, dynamic and sensitively responsive environment immerses the visitor. Its whirly, transitory nature is based on spatial representations of the temporal behaviour of nonlinear, chaotic systems, so-called strange

attractors.[2] The work was implemented for a CAVE Virtual Reality (VR) System, where participants enter a cube the size of a small room, defined by 4–6 projection screens, and are coupled to the VR system by means of a head sensor, mounted on a pair of LCD shutter glasses, and, commonly, one to two hand sensors.

The immersive, spatial interface of the CAVE was essential for *Uzume*'s development, for it allows the 'interface room' to be simultaneously inhabited by a real-time generated data space and a participants' body, and the space to be sculpted by the body's movements. Penny describes conventional VR systems, where "the disembodied gaze had the ability to 'move' on preordained paths within a pre-structured architectonic environment" (Penny 2011: 88). *Uzume* challenges all of these: the disembodied gaze, preordained paths, and pre-structured environment. In contrast to many CAVE environments, *Uzume*'s virtual environment is bound to the physical limits of the CAVE theatre, and participants need to move around and gesture with their two hand sensors to 'negotiate' with a dynamic, ever-changing space. None of its behaviours are scripted and its dynamic nature makes it appear wilful, eluding any control, even the illusion of control.

As the participants move around inside the projection space, they traverse the attractors' parametric fields that are mapped around their body and thus affect the environment's current state. The behaviours adapt over time based on the system's history and the interplay between its internal dynamics and the constant stream of data supplying the participant's position and movements. Each strange attractor is connected to an invisible particle grid that also reacts to the participants' presence. The effect is similar to moving in a viscous medium, gently warping the whirly lines (trajectories) when moving inside them. This elastic connection also made it possible to slowly push and pull the chaotic entities. Thus, the environment responds sensitively in endless fluid variations to each individual visitor.

Communicating with *Uzume* is similar to pursuing a dialogue without knowing the language of the other: all we can do is explore the other's gestural language but the actual meaning is never revealed, never completely decoded, never fully confirmed. Visitors, at first, approach *Uzume* like a puzzle that they can learn to 'figure out' if only they find the key to how it 'works'. But each of their movements causes a myriad of changes in the whirling environment: in shape, scale, density, speed, position, and even the potential for change (computation of new trajectory points per frame). Soon participants realise that *Uzume*'s world is different; too complex to understand and impossible to control. They stop moving to measure, analyse or tame the constantly changing space and begin to dance with *Uzume*. While participants probe *Uzume* with choppy gestures like a specimen, the environment evolves based on the sudden movement data input and appears to be more chaotic, more uncontrollable. Yet, when the participants' movements become more fluid and sinuous, it loses its strangeness, responsively mirroring the visitors' expressive

[2] Some dynamical systems can be highly sensitive to initial conditions, such that very small differences in initial conditions can result in very different behaviours, often referred to as the 'butterfly effect'. Strange attractors are semi-stable, on the borderline between instability and stability and show the unique property that they never travel through space along the same trajectory twice.

Fig. 6.3 Accomplice, robotic installation, 2013 (© Petra Gemeinboeck)

playfulness and, at times, appears to unfold like an extension of their bodies. Now they perform together.

The development of *Uzume* involved hundreds of hours of observation, as it was impossible to directly compose or control how *Uzume* acted. Similar to the experience of the participants, we were confronted with a non-reproducibility and complexity, whose openness also relies on the fact that its potential evolution exceeds our imagination. The only direct control we had was in the mapping between participants' movements and the system's parametric input. This became the focus of our evaluation: that is, how well we were able to respond to the participants' gestures. In the process, we (Gemeinboeck and Blach) often resigned ourselves to describing *Uzume*'s response in anthropomorphic terms, simply to communicate what it looked or felt like but also to develop more expressive mapping relations. We continued to expand the expressiveness of these relations after each exhibition, based on observing the participants' behaviours and affective responses.

6.4.4 Accomplice, by Petra Gemeinboeck and Rob Saunders (2013–Ongoing)

The robotic installation *Accomplice* (Fig. 6.3) embeds a group of autonomous robots into the architectural fabric of a gallery. The robots appear to inhabit the wall, sandwiched between the existing wall and a temporary wall that resembles it. Each robotic agent moves along the wall and is equipped with a punch and a camera eye,

which they use to interact with their surrounds. This interaction is self-motivated; they are autonomous, curious agents, driven to explore their 'world' and discover 'things' they didn't expect. With a punch 'at hand' they are able to affect their world and create new 'things' whenever it seems already too familiar and they lose interest. Moving along the wall they share, they also use their punch to develop rhythmic knocking signals to communicate their presence to each other. As a result of this ongoing piercing, sculpting and signalling activity, the wall increasingly breaks open, and configurations of cracks and hole patterns appear that mark the machines' presence and traces their autonomous agency.

Accomplice explores a similar notion of interactivity to *Autopoiesis*. While the audience's presence and actions matter, the individual robots in *Accomplice* do not rely on input from its visitors to interact with each other, allowing the work to evolve autonomously. The audience plays a part in the work's wider ecology but *Accomplice* doesn't necessarily respond to or perform for them. This is a conception of interaction that, in Simon Penny's words, "has been expanded beyond user-machine, to larger ideas of behaviour between machines and machine systems, and between machine systems and the world" (Penny 2011: 100).

The control system of the robots combines machine vision to detect features from the camera with audio processing to detect the knocking of other robots and computational models of intrinsic motivation based on machine learning. Movements, shapes, sounds and colours are processed, learned and memorized, allowing each robotic agent to develop expectations of events in their surrounds. This adaptive model of their 'world' allows the robotic agents to expect learned behaviours and proactively intervene. To these curious machines, learning and adapting are not goal driven but evolve based on what they discover and interpret as 'interesting' (Saunders 2001).

Accomplice's robotic agents physically inscribe their computational processes into our built environment by turning the wall into a playful stage for creating and learning, similar to a sandpit. Such an autonomous, proactive machine performance challenges common interaction paradigms that prioritise reacting to what is sensed. As the agents are intrinsically motivated to explore their environment, the audience comes into play once they have created sufficiently large openings in the wall for them to detect and study the audience members as part of their environment. The appearance and behaviours of audience members are perceived by the system as changes in their environment. In line with the work's coupling with the built environment, the way in which it involves the audience pursues an expanded, ecological perspective. Thus, it is not only the robots that 'perform' for the audience, but also the audience that provokes, entertains and rewards the machines' curiosity.

Rather than being invited to control the course of events, the audience is implicitly implicated in the material interventions of *Accomplice*; they become an accomplice in the work's ongoing transformations. Initially, it is the physical impact of the work, the loud banging, expelled bits of wall, and dust accumulating on the floor, that draws them in, intrigued, or confronts them with a strange feeling of discomfort. As soon as they realise that there are active machines behind the wall, they often get close to the wall, moving along slowly and peeking into the holes to catch a glimpse

of these strange trespassers. This often is the moment that captures them, and they begin to listen to the rhythmic knocking signals, follow their movements, and patiently wait in front of a hole for one of the robots to peek out, curiously sweeping its camera eye, and suddenly look back at them. It is interesting to observe how keen visitors are to be 'seen' by the robots, for them to acknowledge their presence. Yet the machines will soon lose interest and move on to continue chatting with the other robots or piercing along the raggedy edges of a hole. Similar to Ihnatowicz's observation, the encounter between human and nonhuman agents in *Accomplice* is reminiscent of those we have in the zoo.

Accomplice is the product of an iterative experimental and evaluative process, which started with an earlier work, called *Zwischenräume* (2010–2). In the first version, we (Gemeinboeck and Saunders) took a more anthropomorphic approach to the robots' behaviours, which we then challenged in the next version by developing more machinistic and expressionless behaviours. Based on our observations of the audience response, in connection with our artistic intent, for the third version of *Zwischenräume* we strived for a middle ground, a machinistic design that had some capacity to express its curiosity. *Accomplice* builds on and expands on this hybrid approach by conceiving the robots as social actors that share their wall territory with each other and use their tool to develop rhythmic communication signals.

6.4.5 Zamyatin, by Oliver Bown (2009–Ongoing)

Zamyatin is a system for live improvisation with a human musician, developed over several years by the first author, Oliver Bown. It fits into a class of creative research known as 'live algorithms', which aspires to develop systems that can engage in meaningful musical interaction with a performer. Whilst consistent with the focus of this chapter, this is a context with clear differences to those discussed above. It concerns the domain of musical performance, which has a specific cognitive and perceptual nature (see Cross 2007). It also involves a different presentation format, with a hierarchy of participation, distinguishing system and musician from audience.

In *Zamyatin*, the goal, inspired by behavioural robotics such as the work of Beer (1996), was to take a two-layered approach, integrating a subsystem that might lay claim to behavioural autonomy, feeding into a 'composed' system designed by the author. This approach sees the creation of live algorithms as a design problem, by asking how composers can write creative decisions into a system at the same time as allowing it an operation of its own. Here, the approach to autonomy is somewhat philosophical, based on the idea that neither copycat learning nor the expression of rules, devised by the composer, facilitates autonomy. 'Merely writing musical rules' is considered undesirable, whereas iteratively developing the system behaviour along with the musical parameters the system operates, is seen as a viable creative process leading to a system capable of meaningful musical interaction.

Zamyatin has existed in two major manifestations: first as a continuous-time recurrent neural network, taking directly from Beer (1996); and, second as a decision tree, customised by the author to incorporate internal feedback pathways. In both cases, a fixed set of low-level audio features are extracted in real-time by a 'listening' system to be passed into this decision-making unit. The decision-making unit itself is not designed by the programmer, but is shaped using evolutionary optimisation to achieve abstractly stated behaviours, such as to remain silent until sound is heard at the input, to tend to produce repetitive patterns, or to exhibit behavioural variation over long time scales. For an explanation of the above terms and implementation details see Bown (2011).

Evaluation of *Zamyatin*'s behavioural character has taken the form of informal responses from musicians and fellow practitioners of musical metacreation (MuMe) through 'meet-ups' in which collective performances are presented, for example at the MuMe Weekend at the International Symposium on Electronic Arts in Sydney in 2013. Observation and discussion with the musicians playing with *Zamyatin* reveal interesting differences in the level of expectation, reception, tolerance and compatibility amongst musicians, and understanding how to conceptually frame musician's responses is an important preliminary step to being able to successfully describe the interplay of concerns amongst which the autonomy of the system may be buried. A novel ethnomusicological study by Banerji (2012) of his own software-system 'Maxine' turns a traditional question – how well does the system perform? – on its head, by asking instead how different performers deal with the system in their own playing. Banerji asks, how well did the musicians respond to the system? How does Maxine make them play? As our introductory discussion illustrates, turning to study the behaviour of participants may be the more relevant focus. Banerji approaches the discussion of interaction as if the discourse involved the interaction between two musicians. This, combined with more conventional forms of performer and audience analysis, such as the recent survey-based studies of Eigenfeldt et al. (2012) and Brown et al. (2013), offers a working methodology for analysing the perceived autonomy of the system.

Performers' responses to *Zamyatin* have varied. In three notable cases so far, performers have reported being deeply engaged by the behaviour of the system, leading to a sense of mutual musical exploration. As discussed by Bown et al. (2013) and originally raised as an idea by Pachet (2003), the experience of creative flow during performance with the system is the more immediately pragmatic goal of the performer, rather than any specific sense of autonomy. This pragmatism is reflected in comments by saxophonist Ben Carey on performing with *Zamyatin*:

> I felt there was a responsibility for me to play a leading role, to not get stuck into trying to make the system react to me. – Ben Carey

From this, and similar comments and observations, comes the suggestion that naïve responses that ease this conflict for the musician, may be more crucial to establishing a working musical partnership than more advanced and complex behaviours, even if it means the antithesis of autonomy, i.e., something that the musician can reliably manipulate. This poses the interesting problem of how a rich

autonomy is even manifest in the face of the potentially pragmatic concerns of the performer, which can be examined through further iterations of system prototype development and observation in action.

6.5 Evaluation

Working in the tradition of experimental arts, where the nature of the outcome of the creative process cannot be predetermined, evaluation is an important part of the iterative cycle of observation and adjustment within the creative process. Much of which occurs in the studio, before the work has been finally placed in its interactive context. Reflecting on our own and others' approaches towards evaluating autonomy requires us to consider how artists conceptualise autonomy in their work in order to build a successful set of high-level concepts that can guide their work's development, and how they apply that conceptualisation in the iterative process of tweaking and observing that is required to achieve desired behavioural outcomes.

We suggest that approaches to autonomy can be understood in terms of three rationalisations for why a system is autonomous. The obvious goal is to create a system that *appears* autonomous, demanding of the participant what Dennett (2009) calls an 'intentional stance', that is, a point of view with which one simplifies the understanding of the behaviour of a system by attributing intentions to it. *Autopoiesis* and *The Senster* are examples where the perception of autonomy is a clear goal, even if, as in the case of Ihnatowicz, the creator is surprised by a deeper attribution of intentionality than he aimed for.

But there are additional approaches to the concept of autonomy that impact the way in which evaluation of the work is understood. The first approach is formal. Given a formal understanding of autonomy, such as that of Seth (2010) described previously, or Ashby's notion of homeostasis (Ashby 1954), one can design a system to that specification. Formal approaches provide a way to understand how autonomy might be implemented, and might also be understood by the participants experiencing an artwork. *Uzume* and *Zamyatin* both draw on such formal notions of autonomy, *Uzume* by drawing on the theoretical basis of strange attractors, and *Zamyatin* by targeting simple, formal behavioural targets. As artists, our evaluation of these works engages with issues around how participants experience interaction in the context of these simple formal properties.

The second approach is explanatory. A system may be considered autonomous if there is a reasonable explanation for why it should have acquired autonomous traits, even if this autonomy cannot be immediately measured or observed. Thus a system evolved through simulated natural selection may exhibit autonomy because it acted in such a way as to stay 'alive'. Glynn's *Performative Ecologies* and McCormack's *Eden* are well-known examples of works that make use of audience interaction as the basis for an evolutionary process, which gives a conceptual credibility to the notion that the interacting agents are autonomous. *Zamyatin*'s evolution has a

slightly different significance: to establish behaviour in the agent that is not the direct design of its maker. *Accomplice* involves an explanatory element in the curious nature of the agents, which contributes to the agents' perceived autonomy but may also develop it conceptually.

The above do not constitute evaluative methods in themselves, but may be used to guide the evaluation of works that exhibit and explore autonomy, as understood both by the creator of the work and its audience.

6.6 Conclusions

Interactive experiences with autonomous works are qualitatively different from experiences of reactive or responsive works. The locus of control is shifted from the audience to a shared space in-between and the interaction is more akin to a negotiation or an unscripted dialogue in which the changing character of the work plays a key role in shaping the 'conversation'. In some instances, interaction may be actively sought by the work, for instance, when *The Senster*, *Autopoiesis* and *Uzume* appear attentive, continuously monitoring their domains for change. In other instances, the interaction will appear peripheral, for example, when the social knocking of *Accomplice* or the dynamic swirling of *Uzume* continues to evolve in the absence of an audience. When caught in loops of co-production the interaction becomes an intimate dialogue, as in the playful dance between *Uzume* and a person or when a musician gains fluency with *Zamyatin*. Interacting with these works becomes a co-performance, sensitive to the contingencies of a moment and place, such that each encounter is unrepeatable, a uniquely singular event.

In this chapter we have discussed five works that explore the notion of building autonomy. Through reflection on our own practice, and a review of others' approaches to working with notions of autonomy, we have discussed how this forms a critical basis for the artist's evaluation and iterative development of their work, and how audiences may also take on or independently apply these concepts to the works they experience.

References

Ascott R (2002) Behaviourist art and the cybernetic vision. In: Packer R, Jordan K (eds) Multimedia: from Wagner to virtual reality. W. W. Norton & Company, New York, pp 104–120

Ashby WR (1954) Design for a brain. Wiley, New York

Banerji R (2012) Maxine's Turing test – a player-program as co-ethnographer of socio-aesthetic interaction in improvised music. In: Eighth artificial intelligence and interactive digital entertainment conference, Stanford University, Paolo Alto, CA. AAAI Press. http://aaai.org/ocs/index.php/AIIDE/AIIDE12/rt/captureCite/5533/0/BibtexCitationPlugin

Beer R (1996) Toward the evolution of dynamical neural networks for minimally cognitive behavior. In: From animals to animats 4: proceedings of the fourth international conference on

simulation of adaptive behavior, North Falmouth, Cape Cod, MA, USA. MIT Press, Cambridge, MA, pp 421–429
Boden M, Edmonds E (2009) What is generative art? Digit Creat 20(1–2):21–46
Bown O (2011) Experiments in modular design for the creative composition of live algorithms. Comput Music J 35(3):73–85. MIT Press
Bown O, Eigenfeldt E, Martin A, Carey B, Pasquier P (2013) The musical metacreation weekend: challenges arising from the live presentation of musically metacreative systems. In: Proceedings of the musical metacreation workshop, AIIDE conference, Boston
Brown A, Gifford T, Voltz B (2013) Factors affecting audience perceptions of agency in human computer musical partnerships. In: Proceedings of the 9th ACM conference on creativity & cognition, UTS, Sydney, Australia. ACM, New York, pp 296–299
Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48
Cornock S, Edmonds E (1973) The creative process where the artist is amplified or superseded by the computer. Leonardo 6(1):11–16
Cross I (2007) Music and cognitive evolution. In: Dunbar R, Barrett L (eds) Oxford handbook of evolutionary psychology. Oxford University Press, Oxford, pp 649–667
Dennett D (2009) Intentional systems theory. In: McLaughlin B, Beckermann A, Walter S (eds) Oxford handbook of the philosophy of mind. Oxford University Press, New York, pp 339–350
Eigenfeldt A, Burnett A, Pasquier P (2012) Evaluating musical metacreation in a live performance context. In: Proceedings of the third international conference on computational creativity, Dublin, Ireland. Association for Computational Creativity, pp 140–144
Glynn R (2008) Conversational environments revisited. In: Proceedings of the 19th meeting of cybernetics and systems research, Graz, Austria
Hall J (2010) An autopoietic aesthetic for interactive robotic installation. Available online at: www.jenhall.org/pdf_files/Autopoietic_Aesthetic_JHall.pdf
Haque U (2007) The architectural relevance of Gordon Pask. Archit Des 77(4):54–61
Horowitz AC, Bekoff M (2007) Naturalizing anthropomorphism: behavioral prompts to our humanizing of animals. Anthrozoös 20(1):23–35
Ihnatowicz E (1988) Portrait of the artist as an engineer, unpublished book proposal. Available online at: http://www.senster.com/ihnatowicz/articles/artist_as_engineer.pdf. Accessed on 15 Aug 2013
McCormack J (2001) Eden: an evolutionary sonic ecosystem. In: Kelemen J, Sosik P (eds) Lecture notes in artificial intelligence, vol 2159. Advances in artificial life. Proceedings of the 6th European Conference (ECAL). Springer, Berlin, pp 133–142
Michie D, Johnston R (1984) The creative computer: machine intelligence and human knowledge. Penguin Books, London
Pachet F (2003) The continuator: musical interaction with style. J New Music Res 32(3):333–341
Penny S (2009) Art and artificial life – a primer. In: Proceedings of the 2009 digital arts and culture conference, UC Irvine, CA, USA. http://escholarship.org/uc/ace_dac09
Penny S (2011) Towards a performative aesthetics of interactivity. Fibrecult J FCJ-132:72–108
Reffin Smith B (1984) Soft computing: art and design. Addison-Wesley, London, pp 147–155
Rinaldo K (1998) The flock. Leonardo 31(5):407
Saunders R (2001) Curious design agents and artificial creativity. PhD dissertation, The University of Sydney, Sydney
Seth A (2010) Measuring autonomy and emergence via granger causality. Artif Life 16:179–196
Stern N (2011) The implicit body as performance: analyzing interactive art. Leonardo 44(3): 233–238. MIT Press
Tenhaaf N (2008) Art embodies a-life: the VIDA competition. Leonardo 41(1):6–15
Whitelaw M (2004) Metacreation: art and artificial life. MIT Press, Cambridge, MA
Zivanovic A (2005) The development of a cybernetic sculptor: Edward Ihnatowicz and The Senster. In: Proceedings of creativity & cognition'05, Goldsmiths College, London, UK. ACM, New York, pp 102–108

Chapter 7
Intimate Aesthetics and Facilitated Interaction

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Abstract With the recent emergence of intimate Live Art and performance practices in the past decades, involving artists and audiences interacting in close physical proximity and one-to-one communication, the body is brought centre stage as the site and material of aesthetic experience. Artists working with these modes of address aim to heighten and intensify the experience of the artwork, through the charged energy of face-to-face confrontation, exchange and close bodily proximity. Our particular interest as artistic practitioners is in intimate body-focused aesthetic experiences, mediated by digital technologies that explore the interactions between physiological processes, bodily sensation and subjectivity. In contrast to autonomous art objects that can be experienced by an individual without any assistance by others, we propose a model of aesthetic experience in which facilitation by artists and witnessing by others are integral components. The guidance and facilitation by artists through an experience is intended to provide safe structures and pathways within which a participant can surrender to the potentially immersive and reflective states of consciousness offered by the artwork. Our framework describes four stages of audience experience and participation that can be used to develop and evaluate body-based Live Art encounters: (1) Welcoming, (2) Fitting and Induction, (3) The Ride, and (4) Debriefing and Documentation. We show the application of our model through two case studies from our artistic practices, illustrating our particular perspective on evaluation as a form of facilitated critique and reflection for audience, as well as artists.

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7.1 Introduction

With the recent emergence of intimate Live Art and performance practices in the past decades, involving artists and audiences interacting in close physical proximity and one-to-one communication, the body is brought centre stage as the site and material of aesthetic experience. Artists working with these modes of address aim to heighten and intensify the experience of the artwork, through the charged energy of face-to-face confrontation, exchange and close bodily proximity. Physical and emotional risk and vulnerability are vital ingredients in Live Art transactions. Contemporary Live Art practice plays with the roles of artist and audience, blurring the distinctions between creator and experiencer. With intimate encounters, the artist creates a performance framework (Zerihan 2009) within which the audience becomes an integral part of the process. A similar phenomenon occurs in technology-mediated interactive experiences, where the audience interaction with the system can be regarded as a performance and an aesthetic object in its own right (Saltz 1997). The body is foregrounded as an essential part of the artistic process, be it as the subject, object or medium of action, reflection or transformation.

Our particular interest as artistic practitioners is in body-focused aesthetic experiences, mediated by digital technologies that explore the interactions between physiological processes, bodily sensation and subjectivity. It is an *intimate aesthetics*, where the experience of the body becomes both the subject and object of contemplation. Attention is drawn inwards to the internal landscape, rather than outwards to an external object for contemplation. How you experience yourself, is a question and not a given, and opens an inquiry into the conditions of bodily experience and how these can be manipulated to produce new forms of somaesthetic experience (Shusterman 2000). The fluid boundaries between self, other and world allow for the experience of the physical body as a ground for the imagined body or transformative states of being. The body can be conceptualised as a somatosensory stage (Stenslie 2010), where bodily perception and sensation can be creatively refigured through the application of imaginative techniques, physical conditions and constraints, sensory manipulation and analogue/digital stimuli.

Artworks offering intimate and reflective encounters with one's own subjectivity and bodily experience provide a set of challenges to conventional art making and exhibiting/performance practices. These challenges of audience participation pertain to knowing what to do and how to act in unfamiliar public settings, the resistance to vulnerability in public spaces, and the requirement for sufficient motivation for engaging with interactive artworks that demand sustained focus and concentration. When heightened consciousness and the body is the explicit subject of the work, artists may find inspiration and resources for creating protocols of participation by drawing upon other traditions and frameworks with a history of negotiating and guiding personal experiences in social contexts, for example, religious ritual, public ceremonies, circus and carnival fairgrounds, somatic body-work practices and group therapy.

In contrast to autonomous art objects that can be experienced by an individual without any assistance by others, we propose a model of aesthetic experience in which facilitation by artists and witnessing by others are integral components.

The guidance and facilitation by artists through an experience is intended to provide safe structures and pathways within which a participant can surrender to the potentially immersive and reflective states of consciousness offered by the artwork. Witnessing by spectators can convert what may usually remain a private experience into an object for further contemplation and interpretation by others, extending the reach of the artwork beyond direct interaction to reflection on others' experience. Our framework describes four stages of audience experience and participation that can be used to frame the development and evaluation of intimate and participatory Live Art encounters: The entry stages of (1) Welcoming, and (2) Fitting and Induction, the core experience of (3) The Ride, and the final exit stage of (4) Debriefing (reflection-on-experience) and Documentation (the contribution of experiential artefacts).

7.1.1 Rationale

Our approach places audience experience at the centre of our creative process, and views creative practice as a fundamentally social and relational practice constituted through personal interactions, in which new memories and representations have the potential to transform how we think and feel, through the associations they form. This framework has been developed as a way to examine environmental and interpersonal factors that can impact on the extent to which participants 'enter into' the work. Strategies for encouraging a critical and reflective attitude by audience are embedded in the artwork, effectively an implicit form of evaluation for audience. Knowledge produced by audience through these embodied forms of exploration and reflection is a pivotal concern driving our work, and differentiates our use of evaluation methods, explicitly acknowledging participants as authors of their own experience and co-creators of meaning.

7.1.2 Why Facilitation?

This framework can be flexibly applied or examined by artists and curators to generate, structure and evaluate interactive experiences. We argue that this model creates a place for intimate aesthetics in public spaces that are usually dominated by the spectacular and overt gesture – towards more contemplative and considered qualities of audience engagement with contemporary Live Art practice. The role of the artist becomes that of facilitator in guiding participants through interactions and activities where the relationships between mind, body, environment and other are experienced in new ways or under novel conditions through the mediation of interactive, digital technologies often worn or directly connected to the body.

In this chapter, we demonstrate the application of our model through two case studies from our artistic practices, illustrating our particular perspective on evaluation as a form of facilitated critique and reflection for audience, as well as artists.

7.2 Intimate Aesthetics and Live Art Practices

Intimate Aesthetics occupies a space somewhere between the established forms of interactive, participatory and Live Art, where the participation of the audience of art or the artists themselves is integral to the functioning of the work. Unlike Body Art (Vergine 2000; Warr and Jones 2000), where the body of the artist is the primary art object, for art concerned with intimate aesthetics as we define it, the body of the audience is the material able to be crafted and directly experienced, as for example in works such as Marina Abramovic's 'The Abramovic Method' (Biserna 2012), and Pedro Reyes' 'Sanatorium' (De Looz 2011).

Contemporary Live Art practice celebrates the immediacy and vulnerability of the live event, with a strong emphasis on experience:

> Live Art offers immersive experiences, often disrupting distinctions between spectator and participant. Live Art asks us what it means to be here, now. In the simultaneity and interactivity of a media saturated society, Live Art is about immediacy and reality: creating spaces to explore the experience of things, the ambiguities of meaning and the responsibilities of our individual agency.
>
> [Live Art Development Agency, UK http://www.thisisliveart.co.uk]

Intimacy is a growing phenomenon in contemporary performance practice, as exemplified by one-on-one performances (Heddon et al. 2012). As Zerihan (2009) explains, "a shared and intense desire to connect, engage and discover another elucidates something about the ephemeral liveness of what might lure us toward this close encounter." The desire to connect with others through artistic practice is the theme of Bourriaud's (2002) relational aesthetics. Our work, however, is not so much about fostering social exchange or conviviality, as providing a space for participants to reflect on the internal world of felt experience – and the transformative possibilities offered within facilitated aesthetic experiences. The 'Relational Object' works of Brazilian artist Lygia Clarke provide an important precedent for this shifting of focus from the artist body to the participant body, mediated through a systematic, ritual-like application of wearable objects designed to generate altered experiences of self and world (Osthoff 1997). Our art projects aim to produce conditions for enhanced somatic awareness and pleasure; through the blending of ritual, intimate encounter, and interactive, digital technologies to create interactive, immersive experiences grounded in an intensification of bodily experience. We are putting into practice the philosophical ideas of Dewey (1934) and Shusterman (2000) regarding the intensification and cultivation of aesthetic experience, as highlighted in Chap. 3 ("Evaluation and Experience in Art", Candy 2014).

As art makers we cannot control the particulars of how people experience the artworks we offer, but we can manipulate the conditions and requirements for engagement and perception that give rise to the possibility of a multi-faceted and unconventional aesthetic experience through the alteration of basic conditions of experience such as body orientation (lying down, hanging upside down, balancing, being blind-folded, etc.). Participatory works by artists such as Marina Abramovic (Escape, 1997; The Abramovic Method, 2012) or Belgian ensemble Ontroerend Goed (The Smile Off Your Face, 2003; Internal, 2007) provide vivid examples of the use of such methods in recent Live Art practice.

Artists facilitate what happens to audience, by providing rules or instructions, and direct hands-on manipulation.

> In fact, the instructions are fundamental because the object mustn't be used in any other way. I want the objects to have functions connected with our own basic body positions, which may have to do with sitting or lying down or standing, having your eyes closed or open, not eating or not moving. They are almost requests for commitment; a wrong use would make them meaningless. [Marina Abramovic in Abramovic and Celant 2001, p. 10]

For our practice of Intimate Aesthetics, the aim is to create conditions for people to become more present to themselves through sustained attention to the subtle nuances of their bodily experience. Being guided through a process where the temporal unfolding is carefully controlled enables one to take the time to slow down and savour the subtle processes of bodily experience, often overlooked in everyday life.

Live Art encounters are characterized by "responsibility, risk, exchange, vulnerability" (Zerihan 2009) and require a degree of trust and commitment by both artist and audience. The artist is responsible for crafting the performance framework and setting the boundaries and limits of what is permissible within that frame. The audience is in effect agreeing to this contract of participation, although the protocols of participation and how explicitly they are communicated vary from work to work. In our case studies of artistic practice in Sect. 7.3, we will illustrate some strategies for addressing these concerns of Live Art and Intimate Aesthetics.

7.3 Facilitated Interaction Framework

This framework has been developed from a consideration of traditions and frameworks with a history of negotiating and guiding personal experiences in social contexts. In particular, we reviewed practices with a strong bodily orientation, such as somatic practices (Feldenkrais, yoga, Body-Mind-Centering), physical performance/dances practices (Bodyweather), carnivals and fairgrounds, and religious and performance rituals. Many of these practices have socially recognised protocols for interaction and conduct, where a process or order of events has meaning.

Our model presents four stages of participation that can be selected and composed to form trajectories through an artwork (see Fig. 7.1). It represents an application of Forlizzi and Battarbee's (2004) interaction-centred framework to the domain of intimate Live Art practice: in which technology and design sensibilities are applied to the structuring of interactions facilitated by the artists or trained attendants. Our framework at first glance bears strong similarities to the conceptual framework of Benford et al. (2009), developed out of their long-term research on mixed reality performance and human-computer interaction (HCI). Their notion of "interactional trajectories" to explain "user experiences as journeys through hybrid structures, punctuated by transitions, and in which interactivity and collaboration are orchestrated" (Benford et al. 2009) is a key reference in our work. We re-orient Benford et al.'s framework from a focus on large-scale theatrical action in urban spaces and public institutions to a more intimate, proximal context operating at the scale of the body – and within the body.

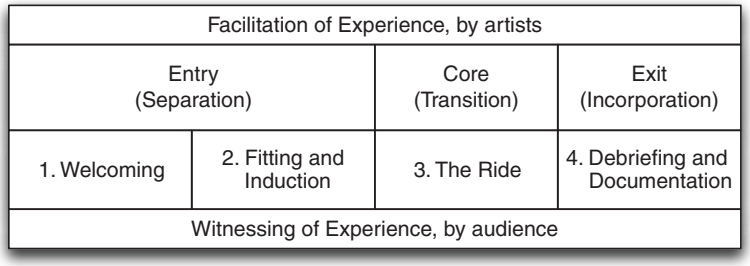

Fig. 7.1 The Facilitated Interaction Framework, four stages of facilitated participation in a body-based aesthetic experience

The importance of designing transitions within trajectories is further developed in our approach, by taking a ritual view of the artwork as a potential transformative experience. The three stages of van Gennep's (1960) *rite of passage* – separation, transition and incorporation – can be used to segment the overall journey through the artwork, one with carefully crafted stages and transitions, including how one enters and exits the 'transition' or liminal zone (Turner 1982). In Fig. 7.1, the correspondence between van Gennep's stages and ours is indicated in brackets in the second row.

The scripting of the entire process is an important aspect, with care being given to timing, cues and transitions. The artist acts as a facilitator to guide the participant through a scripted trajectory. Cues for attention and/or action on the behalf of the artist and participant are built into the script and the composition of the digital, interactive components of the artwork. The cues may take the form of a vocal (e.g., instruction, suggestion, question) or physical (e.g., touch, gesture) exchange between artist and participant.

The scripting of sensation for body-focused experiences can be implemented through vocal guided imagery and stories, and the application of digitally generated multi-sensory physical stimuli (e.g., Stenslie's (2010) "Blind Theatre" uses haptic story-telling to convey digitally-generated tactile sensory information within a narrative composition). Within the scripted interactions, there is some room for improvisation, contingency and responsiveness between the artist and the individual participant (similar to Benford et al.'s (2009) nomenclature of an authored *canonical* trajectory vs. the actual *participant* journey).

Importantly, the framework highlights the social nature of these kinds of intimate transactions in public spaces, where onlookers or spectators may be present in the exhibition environment and able to view some or all of the interacting participant's experience. We refer to this aspect as a witnessing of experience by audience. For strictly one-on-one encounters, where the artist and individual audience participant are alone together, there is no witnessing of this kind. In this case, the artist and participant become witnesses to each other.

Witnessing by others can be controlled and applied to any of the four stages. If artists wish to design witnessing into the artwork, they need to take into consideration individual vulnerability and when it is appropriate for others to view a participant's

activity or documentation. Ethical issues of privacy and confidentiality come into play and need to be carefully thought through.

The four stages are now described.

7.3.1 Welcoming

The first stage, *Welcoming* is where audience are invited to participate in the work. An impression and expectations about the nature of the experience, and appropriate behaviours is formed, upon which the audience makes a choice to participate. This stage can be informed by established techniques from museum studies regarding 'Attractors', as discussed in Chap. 2 ("Human Computer Interaction, Experience and Art", Edmonds 2014).

7.3.2 Fitting and Induction

The second stage, *Fitting and Induction* focuses on the practical aspects of the interaction – how the work interfaces with the participant's body, the ways that the participant can operate the interface or locate themselves within the work, and negotiate risks and processes for opting out. Participants may need to wear special apparatus or use specific devices during *The Ride* as for example in Char Davies' "Osmose" (2003), participants are required to wear a scuba diving-like apparatus on their chest as the input device and a head-mounted display for viewing and navigating virtual environments.

7.3.3 The Ride

The third stage, *The Ride* deals with the core aesthetic experience envisaged by the artist. The concept of 'the ride' is useful for bringing out the temporal structure and dramatic arc of the aesthetic experience. In an intimate Live Art event this may be as formally simple as being present to the artist/performer (e.g., Marina Abramovic, "the Artist is Present"); involve conversational exchanges (e.g., Ontroerend Goed, "The Smile Off Your Face", 2003); or involve the application of objects and sensations to the body (e.g., Lygia Clarke, "Relational Objects", "Canibal Drool/Baba Antropofágica").

7.3.4 Debriefing and Documentation

The fourth stage, *Debriefing and Documentation* provides a double function of ritual closure (or incorporation), and reflection-on-experience. The ritual closure aspect of *Debriefing* provides a crafted transition out of the core experience back into the

everyday world. The participant is assisted out of any apparatus or device attached to the body. They may be led to a separate area where they are encouraged to reflect on their experience and share this with others. This could be through conversation with the artists, reflective writing, non-verbal forms of expression such as drawing or making things, and more informal conversations with other visitors, etc. This transformation of experience through the formation of a reflective narrative, provides a way to explicitly embed the work within a network of other life experiences and reference points, formalizing the experience as *an experience* (Forlizzi and Battarbee 2004).

Documentation further examines how co-experience can be further developed via reflection on *others'* experience, where creative documentation of participant experiences becomes an alternate point of entry into the experiences, sensations and processes explored by the work. Audience may not encounter any of the previous four elements and only see the accumulated traces of activity or reflection left by others. Leaving traces or residue of artistic actions/performance has been employed in body/Live Art practices since the 1960s (Warr and Jones 2000). The shift to documenting audience participation opens up a new space for thinking about how to build this into the overall artwork.

7.4 The Framework in Action

We now illustrate the framework in action through the example of two case studies drawn from our art practices, *The Heart Library* and *Speechless*.

7.4.1 The Heart Library

The Heart Library Project is an interactive art exhibition designed for presentation in hospital and health care settings, museums and art galleries. It combines interactive heart rate controlled audio-visuals with audience participation to create a unique environment where people can reflect, explore and share experiences connected to ideas of embodiment, body-mind and presence.

Participants are invited by the facilitator to explore the use of breath, emotional focus or mental activity to influence the colour and sound of large, ceiling mounted video projection: a mirror image of the participant resting below, created with a hidden video camera. Participants see their own body as if immersed in water and floating above them – like a reverse out-of-body experience. The projected imagery gets redder in colour as their heart rate gets faster, and goes blue when their rate is slowing down. Other visitors can view and witness the participant through a semi-transparent screen surrounding the bed.

After their interaction with the video, participants are invited to contribute a response to the work in the form of a hand-drawn experience map and recorded interviews. These body maps visually capture the highly individual expressions of participant's bodily awareness experienced during the session. These contributions constitute 'The Heart Library' – a celebration and reflection of the body as a living experience, imbued with feelings, motivations, history and imagination.

7.4.1.1 Welcoming

Because of the unfamiliar manner of the interaction (changes in heart rate), and the fact that the interaction takes place in a semi-private booth structure, the facilitator plays a vital role in this work. In the welcome phase, the facilitator is providing prospective participants with the information they need to decide if they want to participate. Unlike clinical biofeedback where clients are motivated by the need to correct or manage a predefined problem, in this case the facilitator works to attract people on the basis of curiosity: introducing the work as an opportunity to explore and experiment with connections between body, mind, stress, and relaxation. The work is explicitly introduced to visitors as an opportunity to explore and share experiences about how they experience these connections. The design of the interaction space (the booth) communicates to prospective participants, the relative privacy of their activities with respect to other spectators.

7.4.1.2 Fitting and Induction

The technology used to measure the changes in heart rate take approximately 30 s to calibrate and detect the participant's pulse. This time is used as an opportunity to outline the basic structure of the interaction, what is being measured, the manner in which they can navigate the work (and explore their agency) and how long it can last (this is usually left for them to decide, except when there are more people waiting for a turn). The participant's pulse is sonified as a deep throbbing sound, and visualized as subtle contractions in the shapes floating across the screen. The facilitator explains to them that this sound is live, being triggered by their own pulse. Participants are then instructed of basic ways that can speed up or lower their heart rate, and to test out one of these methods and observe the resulting change. The Fitting and Induction stage here is all about helping participants find their bearings within an unusual situation, where lines between self and other are hard to delineate ("is that me, or just the computer being random?"). The work itself is directly concerned with facilitating experiences of self arising from close attention to vital signs. During the fitting and induction participants are learning for the first time, the basic conditions for being-in-this-world as constituted by the interfaces and interactions – how they need to be and do, in order to see themselves reflected in the work.

7.4.1.3 The Ride

During this stage of the work, participants typically alternate between periods of immersion, and reflection-on-interaction as they experiment with ways in which they can alter the behavior of the work through changes in heart rate controlled by their breathing and stress/relaxation responses. The nature of the interaction is paradoxical, as participants are required to direct attention simultaneously into their body (heart beats, breath, muscle tonus, etc.) and then outwards, to a spatially displaced image of themselves floating above them on the ceiling of the installation space. The Heart Library makes this aspect of the interaction visible to other viewers, who can glimpse the projected video imagery on the ceiling of the booth – through semi-transparent screens that comprise the structure's walls. In order to support full attention to the interactive experience, considerable care is taken to communicate a sense of security and manageable risk. The booth structure is designed so as to strike a balance between the need to provide individual participants some sense of privacy and security, and providing a space where other visitors can be present to the processes unfolding inside the booth. Entrances and exits are placed so as to remove the possibility of 'strangers' entering the space without the participant knowing well in advance – to manage the sense of vulnerability they might otherwise feel in lying prone in a dark but ultimately public and social space.

7.4.1.4 Debriefing

Audience contribution is central to the concept of the work as both a place to be present to aspects of our embodiment, and a place for the exchange of experiences through conversation and story-telling. Based on previous research into audience's experiences in this type of interaction, it was clear that people often find it difficult to articulate their experience after such an immersive and private interaction, so a private mapping process was devised as a way for participants to debrief/decompress, and to gather the most significant aspects of their experience to share with exhibition visitors. Participants are led to a separate interview area, and invited to share some aspect of their experience in the form of a hand-painted map describing sensations and images they experienced within and around their body, during the interaction.

The objective is two-fold: to create representations of and reflections on subjective experience that can serve as visual stimulus for formal and informal conversations; and to facilitate the articulation of personalized narratives describing experiences of embodiment, and body-mind interconnectedness. The use of body-maps (Fig. 7.2) to locate and describe experience scaffolds the drawing process making it less daunting for participants unaccustomed to drawing, the task being first and fore mostly to describe and locate the subjective experience, and not to make an artwork per se. The method was inspired by the use of body-maps in medical practices to locate pain in and around the body. Complementary to the body maps, audio recordings were made of interviews with the participants. The verbatim quote below illustrates the potential power of tools for self-reflection mediated by biofeedback technologies and facilitated through further reflection-on-experience.

Fig. 7.2 Body maps produced by participants during Debriefing and Documentation

> What really interested me was that if I had a thought that was self-critical – then all the dots went red – then when I said *I accept myself* – it all went blue. I thought *how quick is that!* … Just knowing that I'm capable of big things … and at the moment I'm dealing with a life-threatening illness – so that's important for me – that I'm actually capable of stepping into another realm as well [Extract from transcripts of interviews with exhibition visitors at St. Vincent's Public Hospital, Darlinghurst.]

In prior works Khut had researched audience experiences of his works with curator Lizzie Muller, as a way to test their assumptions as artist and curator about how these interactions reverberate in the subjective experiences of individual participants, using methods such as video-cued retrospective reporting to document individual experiences, and experience workshops to re-assess the experiential goals against emerging patterns of association, curiosity and frustration across different participants (Khut and Muller 2005; Muller et al. 2006a, b). In the Heart Library Project – audience research methods are appropriated as tools for facilitating reflections on experience that are then shared with other visitors.

7.4.1.5 Documentation

The resulting body of drawings and interviews recorded in the Debriefing and Documentation stage are exhibited next to the interactive video booth; as videos documenting the creation of the drawings in time-lapse, as the drawings themselves – pinned to the wall or displayed in cases; and as audio recordings played through speakers or headphones. As a highly specialized social space – the exhibition is

Fig. 7.3 Lung Station, one of four experiential stations in the Speechless installation environment, Critical Path Choreographic Research Centre, Sydney, 2011. Facilitator attaching a breath sensor to participant's chest (Image credit: Alex Davies)

developed here literally as a "Living Lab" designed to facilitate actual hands-on exploration, reflection and discussion around themes of embodiment and health care. These artefacts attest to the range of experiences supported by the work, locating the individual participants' experience within the broader social context of other people's experiences.

7.4.2 Speechless

Speechless is a participatory live-art installation composed of a series of experiential body-focused stations, each one providing a different yet related experience of the body (Fig. 7.3). The first two stations—the Lung Station and the Heart Station—invite individual participants to experience their breathing and heartbeat under conditions of constriction and compression, amplified respectively through breath- and pulse-sensing digital soundscapes. The third station—the Spine Station—offers an experience of compression without any electronic technology. The fourth station—the Recall Station—invites audience to reflect on their experiences of the previous three stations through a prompted interview. At each station, a guide is responsible for leading the participant through a scripted journey. All stations operate in parallel, so there can be up to four participants at a time active in the installation environment. These four participants are privy to the activity in the room and can witness each other's interactions if they wish.

7.4.2.1 Welcoming

Interested participants wait in a room separate to the main installation space. An information sheet outlines the aims of the artwork and draws attention to the proximal, intimate nature of the interactions. Clear instructions are given that participants can exit at any time, with the assistance of a guide. A guide meets the participant in the waiting area and invites them to remove their shoes and put on a mask. This step begins the next stage of Fitting and Induction.

7.4.2.2 Fitting and Induction

Participants are escorted into the space blind-folded for the first stage of their experience. Before moving to the Lung Station, each participant is gently guided onto a pebbled area underfoot and slowly walked in a circle—a *threshold moment* designed to disorient their sense of where they are in the space and to heighten their (non-visual) senses. The combination of the visual deprivation and walking in a circle is supposed to function as an initiation into a special or ritual space—of a different order to the everyday.

For the Lung and Heart Stations, fitting of the breath and pulse sensors (respectively) takes place at the beginning of the journey. The process for the fitting is scripted and choreographed, with careful attention given to how the facilitator and participant organize their bodies in relation to each other, the apparatus and the space. For the Lung Station, the idea of constriction was introduced through the binding of straps around the body from the ankles to the shoulders – echoing the binding of the breath sensor around the chest. For the Heart Station, the idea of compression was implemented through placing a series of sculptural, clay objects on the body as instructed by the participants.

7.4.2.3 The Ride

The core experiences take place in the Lung, Heart and Spine Stations. In this artwork the perception and performance of one's own bodily processes (such as breathing and heartbeat) is brought into sharp focus. Each of these is scripted with regards to the actions and responses of the facilitator and participant, in a one-on-one exchange, directed towards new experiences of breath, heart-rate and weight.

The scripting of action enabled us to prompt the participant in the use of their embodied imagination in a way that was sensitive to where they were in the temporal structure of the work. We applied techniques from Bodyweather for transforming a sense of self through the embodied imagination, aiming for participants to be simultaneously deeply present in their body and potentially experiencing a sense of embodiment beyond the human scale. The concept of scaling imagery located in the body and extending beyond the body was translated into the script and suggested to the participant at key points in the journey. Through the explicit use of imagery,

Fig. 7.4 Recall Station for Debriefing. A facilitator prompts the participant to verbally describe and recount their immediate experience (Image credit: Alex Davies. Image Copyright ACM 2012. Originally published in Lian Loke et al. (2012))

suggestion, atmospheric sounds, timing and so on, we could create conditions conducive to deeper states of immersion and contemplation. This is an established method in somatic practices where instructors provide guided visualizations for exploring and achieving somatic states (e.g., relaxation, meditation).

At the conclusion of the Lung Station, the guide removes the mask and then escorts the participant to the Heart station, where another guide takes over. At the Spine Station, the participant is invited to lie down spine to spine with the facilitator, to explore the relationship between breathing and weight. Participants are navigated through the four stations, culminating at the Recall Station, which functions as a Debriefing station.

7.4.2.4 Debriefing and Documentation

At the Recall Station, participants are invited to recount and reflect on their experiences (Fig. 7.4). It is conducted as a conversation between the participant and guide, with the guide gently prompting the participant and allowing them to do most of the talking. The conversations are recorded for later analysis.

In terms of Debriefing, this process of sharing helps crystallize the experience for the participants, providing a sense of ritual closure before they step back into the everyday world. This careful orchestrating of the ritual nature of the interaction is common in religious, somatic and performance practices where people have

entered states of altered or heightened reality and need to be brought back to a normal psychological state (Schechner 2003).

The aspect of Documentation as a form of co-experience was not developed in this work. However the participant accounts gathered from the Recall Station do suggest that some of the experiential goals were met. Participants described highly evocative and intense body-oriented experiences arising from the interplay of attention to breath, pulse and weight, unusual objects and apparatus placed on the body, the digitally generated responsive soundscapes and the physical proximity and contact with the guides.

> The binding, however, shifted my focus to the operation of breathing; the shifting volumes of oxygen; taking my sensibility, paradoxically, deeper within and expansively outward. [Participant verbatim quote]

Some concerns were raised with the physical interaction of the Spine Station, where the guide and participant lie down back to back, as not all participants felt comfortable with this arrangement. Most participants were quiet and introspective during their encounters – the expected response within an environment of primarily internal focus. However some participants were more vocal and responded with a running commentary on what they were experiencing – inadvertently incorporating a form of spontaneous think-aloud (an established HCI evaluation method). For a more extended account of the use of HCI evaluation methods in Speechless see Loke et al. (2012).

7.5 Discussion

Many contemporary artists are currently working with audience experience and participation as important elements of their practice, particularly in the realm of interactive art (Saltz 1997; Bishop 2006; O'Reilly 2009). There is growing interest in applying established methods from HCI to these novel artistic contexts in order to understand the audience experience of the interactive artwork (e.g., Höök et al. 2003; Khut and Muller 2005; Bilda et al. 2006; Khut 2006; Muller et al. 2006b; Edmonds 2010; Latulipe et al. 2011). Methods for accessing and evaluating user experience such as think-aloud protocols, co-discovery, recounts, video-cued recall, interviews and questionnaires can provide artists and researchers with valuable insights into the audience experience. These methods can be applied in an iterative process of making and evaluating, so that understandings of audience experience are folded back into the developing work (Edmonds 2010).

The two case studies presented above illustrate different approaches to the incorporation of HCI evaluation methods in interactive art practice. The Heart Library (and prior work) was developed iteratively with periods of audience testing of evolving prototypes (Khut and Muller 2005). An alternative application of HCI evaluation methods took place in Speechless, with the embedding of simple evaluation methods such as interviews into the fourth stage of Debriefing (Loke et al. 2012).

In the Heart Library, body maps were used as a tool for audience to reflect on and evaluate what they just experienced. By embedding tools for facilitating and capturing audience contributions of their bodily experience within the artwork (drawn from HCI, medical and therapy practices), artists can continue to collect data on audience experience for evaluative purposes during exhibition. But just as importantly, the use of these tools can facilitate a more extended reflection-on-experience on the part of the audience, as an elaboration of experimental psychological processes explored in body-focused Intimate Aesthetics.

The framework we presented is primarily concerned with the facilitation and overall structuring of an aesthetic experience, however it can also be used in an evaluative sense by considering whether specific stages of participation are appropriate for a particular artwork. In simplistic terms, most artworks could be seen as The Ride, presented in galleries and public spaces with minimal facilitation. For many interactive, participatory, and process-based artworks centred on the body, some form of facilitation or induction is required by either the artist(s) or their proxies. The stages of the framework provide a tool for artists to assess the stages of participation, the structure and flow of experience, with special attention to the entry and exit stages and transitions. The entry stage works to prime and orient participants, setting up expectations for protocols of participation, which may result in deeper and more satisfying levels of engagement with the artwork. Similarly, the exit stage can function to provide participants with a sense of closure, time and space to mentally, emotionally and physically transition out of the core experience and tools for reflecting on and sharing what they just experienced.

Curators can potentially expand the remit of the artwork beyond the core experience to incorporate strategies of entry and exit stages for enhanced audience engagement. This approach could be combined with the interaction design and technology augmentation of artistic exhibitions, described by Kortbek and Grønbæk (2008), where Mariko Mori's artworks were augmented with various forms of digital and tangible interactions intended to expand opportunities for audience engagement with the works.

The following questions can help artists and curators think through the development and evaluation of the work:

- Where/when does each aesthetic experience start/end?
- What is under the control of the artist/curator/audience?
- What is part of the sanctioned event? And what arises informally around it?

7.6 Conclusion

Creating body-focused aesthetic experiences requires a sensitivity to the vulnerable and visceral qualities of the body. How artists approach the crafting of new forms of bodily experience relying on the participation of audience is being explored within Live Art and interactive art practices. By nesting the individual aesthetic encounter within a framework of facilitated interaction and shared experience, the artist can

offer safe structures and pathways within which a participant can surrender to the potentially immersive and reflective states of consciousness offered by the artwork.

Our Facilitated Interaction Framework structures bodily-focused aesthetic experience into four stages of Welcoming, Fitting and Induction, The Ride, and Debriefing and Documentation. It highlights the importance of scaffolding the core experience with carefully crafted entry and exit stages and transitions. The trajectory through these stages is scripted and facilitated by artists, to ensure participants are provided with adequate guidance for entering, orienting, navigating and exiting through the various stages. Issues of trust, risk, vulnerability and privacy for participants in intimate Live Art contexts are raised for discussion and negotiation – both in terms of the facilitator-participant interaction and the participant-witness relationship. We leave it to a future extension of the framework to include principles and strategies to evaluate and mediate these issues of body-based intimate aesthetics in public spaces.

The framework we presented for facilitating Intimate Aesthetics in Live Art contexts has application beyond body/process-based work, although that was our particular focus. Artists and curators can use it as a tool for evaluating and generating experientially focused events. It can be used more generally, in combination with other frameworks and methods, to consider the structuring of interactive experiences in public settings and the use of more utilitarian body-focused technologies that require some form of guidance, assistance or facilitation.

References

Abramovic M, Celant G (2001) Marina Abramovic: public body: installation and objects, 1965–2001. Charta, New York/Milan

Benford S, Giannachi G, Koleva B, Rodden T (2009) From interaction to trajectories: designing coherent journeys through user experiences. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'09). ACM, New York, pp 709–718

Bilda Z, Costello B, Amitani S (2006) Collaborative analysis framework for evaluating interactive art experience. J CoDesign 2(4):225–238, Taylor and Francis

Biserna E (2012) Exhibition reviews: 'The Abramović Method', PAC Padiglione d'Arte Contemporanea, Milan (March-June 2012), NECSUS. Eur J Media Stud 1(2):338–346

Bishop C (ed) (2006) Participation. Whitechapel Gallery/MIT Press, London/Cambridge, MA

Bourriaud N (2002) Relational aesthetics. Les presses du reel (English trans), Djon

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

De Looz PA (2011) Pedro Reyes Brings Sanity to Brooklyn. In: Art in America, June 2011

Dewey J (1934) Art as experience. Capricorn Books, New York

Edmonds E (2010) The art of interaction. Digit Creat 21(4):257–264

Edmonds E (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23

Forlizzi J, Battarbee K (2004) Understanding experience in interactive systems. In: Proceedings of the 5th conference on Designing Interactive Systems: processes, practices, methods, and techniques (DIS '04). ACM, New York, pp 261–268

Grau O (2003) Charlotte Davies: Osmose. In: Virtual art, from illusion to immersion (Revised edition MIT Press, Cambridge, MA, pp 193–211)

Heddon D, Iball H, Zerihan R (2012) Come closer: confessions of intimate spectators in one to one performance. Contemp Theatre Rev 22(1):120–133, Special issue: live art in the UK, Taylor and Francis

Höök K, Sengers P, Andersson G (2003) Sense and sensibility: evaluation and interactive art. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'03). ACM, New York, pp 241–248

Khut G (2006) Interactive art as embodied enquiry: working with audience experience. In: Edmonds E, Muller L, Turnbull LD (eds) Engage: interaction, arts & audience experience. Creativity and Cognition Studios Press, Sydney, pp 156–167

Khut G (2007) The heart library project. http://georgekhut.com/heartlibrary/

Khut G, Muller L (2005) Evolving creative practice: a reflection on working with audience experience in cardiomorphologies. In: Anastasiou P, Smithies R, Trist K, Jones L (eds) Vital signs: creative practice & new media now. RMIT Publishing, Melbourne

Kortbek K, Grønbæk K (2008) Communicating art through interactive technology: new approaches for interaction design in art museums. In: Tollmar K, Jönsson B (eds) Proceedings of the 5th Nordic conference on human-computer interaction: building bridges. ACM international conference proceeding series, ACM, New York, vol 358, pp 229–238

Latulipe C, Carroll EA, Lottridge D (2011) Love, hate, arousal and engagement: exploring audience responses to performing arts. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'11). ACM, New York, pp 1845–1854

Loke L, Khut GP, Kocaballi AB (2012) Bodily experience and imagination: designing ritual interactions for participatory live-art contexts. In: Proceedings of the designing interactive systems conference (DIS '12). ACM, New York, pp 779–788. doi: 10.1145/2317956.2318073, http://doi.acm.org/10.1145/2317956.2318073

Muller E, Robertson T, Edmonds E (2006a) The object of interaction – the role of artefacts in interaction design, experience workshops. In: Proceedings of workshop, OZCHI 2006, Sydney, Australia

Muller L, Turner G, Khut G, Edmonds E (2006b) Creating affective visualisations for a physiologically interactive artwork. IV 2006. Tenth international conference on information visualization, 2006, London. IEEE Computer Society, Washington, DC, pp 651–657

O'Reilly S (2009) The body in contemporary art. Thames & Hudson, London

Osthoff S (1997) Lygia Clark and Hélio Oiticica: a legacy of interactivity and participation for a telematic future. Leonardo 30:279–289

Saltz DZ (1997) The art of interaction: interactivity, performativity, and computers. J Aesthet Art Crit 55(2, Spring): 117–127, Perspectives on the arts and technology

Schechner R (2003) Performance theory. Routledge Classics, London

Shusterman R (2000) Performing live: aesthetic alternatives for the ends of art. Cornell University Press, Ithaca

Stenslie S (2010) Virtual touch – a study of the user and experience of touch in artistic, multimodal and computer-based environments. Oslo School of Architecture and Design, Oslo

Stenslie S (2010) The blind theatre – 5 manifests for the female sensuality [Online]. Available: http://blindtheater.wordpress.com

Turner V (1982) From ritual to theatre: the human seriousness of play. PAJ Publications, New York

Van Gennep A (1960) The rites of passage. Routledge & Kegan Paul, London. Reprint 1977. Originally published 1960

Vergine L (2000) Body art and performance. Skira Editore, Milan

Warr T, Jones A (2000) The artist's body. Phaidon Press Ltd., London

Zerihan R (2009) One to one performance: a study room guide. Live Art Development Agency, London. Available at: http://www.thisisliveart.co.uk/resources/catalogue/rachel-zerihans-study-room-guide. Accessed 20 Feb 2014

Chapter 8
The Network Unveiled: Evaluating Tele-musical Interaction

Roger Mills and Kirsty Beilharz

Abstract This chapter outlines a multimodal framework for the analysis of interaction in networked improvisatory musical performance. The framework has been designed as a tool to evaluate the creative and cognitive approaches taken by expert cross-cultural musicians when navigating a dislocated networked experience in unfamiliar musical terrain. Potentially these ideas are applicable across a range of collaborative and interactive media. The methodology employs a social semiotic perspective and draws on the related field of cognitive linguistics to analyse the ways in which the qualities of sound (timbre) in melodic interaction are perceived and acted upon by networked musicians. Case studies consisting of audio-visual recordings and transcripts of musicians' post-performance reflections provided the data for investigating representation, interpretation and response in improvised musical interaction. While much existing networked music research focuses on technologies for improving and expanding interaction, as the title of this chapter suggests, there is a need for an evaluative framework and language for 'unveiling' or 'revealing' musicians' creative and strategic thought-processes. For networked musicians, this involves negotiating the unknown in first encounters with new musical cultures, interacting via new musical languages, practices, expectations and potentially unfamiliar instruments. These unprecedented experiences enabled by networked technologies create the motivation for further qualitative analysis of networked interaction.

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8.1 Introduction

Networked music and sound performance have become significant areas of interest to contemporary musicians, composers and audiences alike. The recent popularity of pop music artist Gotye's Youtube Orchestra (Gotyemusic 2013), and The Youtube Symphony Orchestra (Symphony 2010) demonstrate how a-synchronous and synchronous networked music performance has begun to capture the wider public imagination. However, networked music has a much longer history of technologists and musicians developing interfaces and collaborations on purpose-built low latency, high-fidelity platforms that facilitate hitherto improbable meetings between musicians of diverse cultural and musical traditions. Perhaps because of the ad-hoc nature of these collaborations, improvisation is a key feature of this style of performance. And, like much co-located improvised music, it challenges the traditional roles of the artist and audience, where the performative experience is often a shared participatory interaction between the musicians themselves. This shares many of the implications brought about by shifts in interactive digital media in which audiences have been transformed from viewers to participants, expounded in Chaps. 3 and 9 ("Evaluation and Experience in Art", Candy 2014; "Mutual Engagement in Digitally Mediated Public Art", Bryan Kinns 2014).

To gain a greater understanding of interaction in a telematic[1] collaborative context, therefore requires a move away from established paradigms of co-located performance evaluation, to a practice-led model of assessing musicians' distributed, formative and spontaneous creation of improvised music (Candy 2006). The term practice-led is used here to describe research with a primary focus on understanding "the evolution of new practices" (Candy 2011, p. 35), i.e. of research arising from the needs and enquiries of practice, rather than with the sole intention of developing an artefact.

8.2 Background

The literature of social semiotics, multimodality and cognitive linguistics all emphasise that it is our physical interactions with the world as discourses of social practice that provide us with a conceptual framework for interpreting the meaning of those interactions. This derives from their shared linguistic heritage but more importantly it underscores the nature of networked musical improvisation as an embodied social practice. The results of multimodal discourse analysis (MDA) of inter-cultural networked interaction demonstrate that each of these modes has something distinctive to tell us about the construction of meaning between geographically dispersed musicians of different cultures and musical traditions.[2]

[1] Telematic refers here to the technological infrastructure that enables geographically dispersed, and networked computer mediated musical interaction.

[2] Kress refers to multimodality (Kress and Van Leeuwen 2001, p. 1) and this research extends his ideas to the context of intercultural networked collaboration.

8.2.1 Melody and Timbre as Semiotic Resources

In this research, melody and timbre are viewed as "semiotic resources" that can describe "what you can 'say' with sound, and how you can interpret the things other people 'say' with sound" (Van Leeuwen 1999, p. 4). It is proposed that representation and interpretation in networked musical interaction originate as shared metaphors of experience, generated from sounds based on an understanding of how they are physically produced (Van Leeuwen 1999). In these studies, an examination of the experiential qualities of the musicians' improvised interaction allows for an evaluation that maps musical instance to gesture and reflective experience. This affords an insight into the creative and cognitive aspects of networked engagement where "observations of art as experience provide the basis of evaluation" (Candy 2013). As network technology facilitates new fields for inter-cultural interaction in music and the digital arts, social semiotics can provide the necessary tools for the analysis and evaluation of networked experiential engagement across a range of disciplines.

The field of networked collaboration is a fast-growing area that spans a number of disciplines. Much work has already been achieved in CSCW research (computer supported cooperative work) in developing frameworks in which to improve our understanding of dispersed collaboration, particularly in education and the workplace. However, many of the central theoretical perspectives of CSCW such as symbolic interactionism, activity theory and distributed cognition are not well suited to understanding the experiential and embodied characteristics of the physical production and interpretation of sound. We therefore argue that a social semiotic perspective best achieves an evaluation of interaction in networked improvised music by accounting for "felt significance of sound" (Cumming 2000, p. 134) and its interpretation across cultures.

8.2.2 Networked Performance

A feature of networked musical performance is that our understanding of telematics is sometimes clouded by the technical and conceptual parameters in which it takes place. Performances can involve an array of instrumental, technical and network configurations drawing together musicians with little or no understanding of the distributed environments in which the performance is occurring. Interaction in networked improvisation is distinguished from interaction in co-located contexts because performers interact without the expressive signifiers of body language and facial expression that are present in co-located (same venue, shared space, visually and gesturally interactive). Dedicated low-latency (network delay) telematic interfaces require high network speeds, and currently do not support robust video streaming of collaborators on domestic connections. Web-based video streaming applications not only make high demands on available bandwidth, but even when employed on high-speed research networks, visual

fidelity lags noticeably behind the audio. This appears to be of lesser importance to musical interaction than one might think. Caceras et al. (2008) found that networked musicians don't generally look at video streaming when they perform but suggest that it "serves primarily the purpose of providing an experience for the audience" (Caceras et al. 2008, p. 63). Rather than it being an essential component of networked interaction, visual streaming functions as a "material anchor" (Hutchins 2005, p. 1573) for conceptually bridging embodied located and dislocated experience.

Evaluation of networked musical interaction therefore requires us to look beyond the situated, visual and sonic 'aesthetics' of musical performance, in favour of the way in which dispersed musicians perceive and respond to representation and meaning in the "flow" of networked improvisatory performance (Csikszentmihalyi and Csikszentmihalyi 1993).

8.2.3 Multimodal Discourse Analysis

This research describes an analytical framework employing multimodal discourse analysis (MDA) that emerged in the 1980s and 1990s from linguists Michael Halliday, Robert Hodge, Gunter Kress and Theo van Leeuwen, who proposed that "meaning is not only communicated through language but also through other semiotic modes" (Machin and Mayr 2012, p. 6). As a practice-led model, it provides a valuable instrument for the evaluation of interaction in networked musical improvisation wherein multimodal data (video, music and text) are "recontextualisations of social practices" (Van Leeuwen, quoted in Lindstrand, 2010, p. 87), while acknowledging "interpretation is also a semiotic action" (Kress and Van Leeuwen 2001, p. 40). The analytical framework also adopts ideas from the field of cognitive linguistics, that similarly focuses on "the relation of language structure to things outside language: cognitive principles and mechanisms not specific to language" (Klemmer 2010). The experiential and material qualities of different modes of discourse are foregrounded by the inherent parallels between MDA and cognitive linguistics, and also through the interpretation of those discourses.

Multimodality is crucial for developing an understanding of musical and experiential interaction in networked improvisation from different cultural perspectives, in which the same musical interaction may have more than one interpretation. Cultural nuance has sparked long-running debates in musical aesthetics, e.g. whether musical meaning resides within the formal structure of music itself, or is the result of "symbolisms depicting actions, character and emotion" (Meyer 1956, p. 2). The authors take Van Leeuwen's position that music and sound are dynamic. A social semiotic perspective views this as representing the actions of people, rather than representing the objects or things themselves (Van Leeuwen 1999). This is particularly relevant in improvisation where, as Berliner (1994) argues, "the ideas that occur during a solo assume different forms of representation: sounds, physical gestures,

visual displays, and verbalisations. Each potentially involves distinctive thought processes and distinctive qualities of mediation with the body" (Berliner 1994, p. 206). MDA facilitates the examination of sounds, gestures and verbalisations through music, video and text, foregrounding the creative and cognitive components of networked improvisational interaction.

8.3 The Framework

The analysis of music, video and text within Mills' framework (presented in this chapter) can therefore capture insights that might otherwise be missed by examining one of these expressive modes in isolation, and it provides for a more thorough evaluation of musicians' interactive experiences. It also demonstrates recognition of the "affective" force of sound that as Coker (1972) argues, "activates emotional patterns of behaviour" (Coker 1972, p. 39). Our understanding and hence interpretation of experiential meaning in music is conceptually structured by embodied patterns in melody, rhythm, pitch, tonality and timbre that act as semiotic resources analogous to the physical production and vocalisation of speech acts. As Van Leeuwen argues, "the dividing line between speech, music, and other sounds is very thin. Many of the same kinds of things can be done verbally, musically or by means of 'noises'" (Van Leeuwen 1999, p. 92). In other words, representation and meaning are viewed as emerging from our understanding of the physical experience of producing patterns of speech. This occurs in melody through our experiential understanding of what we physically have to do to produce a type of sound with our voice and body, for instance, speaking or singing in a low voice and increasing vocal effort to raise the pitch. As Van Leeuwen points out, "how people (composers, musicians, professional interpreters, audiences) interpret and experience this pattern, their experiences are likely to be in the same broad area" (Van Leeuwen 1999, p. 94). In this sense, the experience of force, or moving our bodies in motion, or standing upright conceptually structure our understanding of musical interaction through *schematic* relationships, e.g. related physical effort to the production of high or low pitch ranges and associated metaphorical perception of excitement or relaxation. It should be stressed that we are not claiming that musicians consciously think in, and of these terms, but rather that they result from their verbalised perception of interaction (Fig. 8.1).

It emerges that conceptual metaphor is key to understanding networked musicians' patterns of experience. In this light, "metaphor is not merely a matter of language, it is a matter of conceptual structure […] it involves all the natural dimensions of our experience, including aspects of our sense experiences: colour, shape, texture, sound etc. These dimensions structure not only mundane experiences but aesthetic experience as well" (Lakoff and Johnson 1980, p. 235). While recognising cultural distinctions, metaphor plays an in integral role in the examination of cross-cultural networked musicians' experiences.

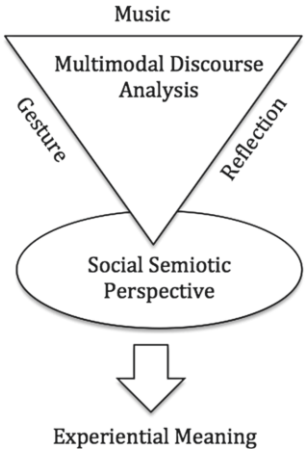

Fig. 8.1 Illustrates the interrelationship of multimodal discourse analysis and social semiotics in analysing and evaluating experiential meaning in networked improvisation

8.4 Application of the Framework to the Case Studies

Here, we demonstrate the analytical techniques of the framework and how the analysis evaluation of melodic and timbral interaction between expert cross-cultural musicians is achieved. The definition of a 'cross-cultural' musician in this context is to denote cultural heritage, rather than to imply a musical practice. Case study examples are used to illustrate how the analysis of music, instrumental gesture and the musicians' reflective experiences can lead to an evaluation of the strategies that musicians develop to navigate dislocated and unfamiliar musical terrain.

To examine musical and cognitive interaction, it is necessary to listen to, and observe the participants improvising from geographically dispersed locations, and to ask them to reflect on their experiences. Reflective Video Cued Recall (VCR) (Omodei and McLennan 1994; Raingruber 2003) procedures were utilised, in which musicians were played a video recording of their performance and asked to stop the video, and to verbalise their experience as they recall their interaction.

As a first step, the analysis focuses on the cognitive experiences of one Australian musician in relation to several musicians of Asian and European cultural heritage. This provides a lens through which to view the interaction that is subsequently cross-referenced with the reflective experiences of the other participating musicians.

While the researchers were able to observe the focus musician and conduct the VCR session immediately after each improvisation, for logistical reasons this was not possible with the international networked musicians. Review was achieved by transferring the audio-visual data via a file transfer application immediately after the performance, then uploaded to a private YouTube channel, within a 24–48 h period following the session. The VCR was then conducted via the Google Hangouts application, which allows for real-time stop and start YouTube clips, allowing the participant and researcher to stop the video where necessary. The VCR audio was

then recorded by the QuickTime application for later transcription and the process of identifying musical interaction began. Where necessary translators were also present in the recording of the VCR data.

8.4.1 Parameters of Interaction in Melody and Timbre

The process of identifying parameters of interaction in melody and timbre requires the examination of four specific components of music and sound derived from the analysis, and guided by Mills' extensive experience in the field of networked improvisation. They are;

Musical initiation, what forms of musical motif or sound are used to begin an improvisation; initiate new sections within an established improvisation session (melody, rhythm, harmony, timbre); combinations of instruments. *Motivic development*: how does melodic or timbral interaction evolve; the ways in which melody and qualities of sound are employed by networked musicians, and what musical forms do their responses take, e.g., melodic, timbral, rhythmic. *Harmonic development*: how is tonality established, which instrument and musician/s initiate it, how do other musicians respond?

Timbre: what qualities of sound are being used (instruments, approaches to using qualities of sound); passages in which timbre is predominant in interaction; which instrument and musician/s initiate it, and how do other musicians respond to it.

8.4.2 Data Collection

The video and audio recordings of the case study performances and VCR transcripts provided a very rich source of data and were invaluable for drawing relationships between instances of musical interaction, performative gestures and what the musicians verbalised about their experiences of the interaction. From a multimodal perspective, it was also necessary to view the data sets together. This provided a challenge in being able to listen to the musical improvisation, observe the musicians' gestures and read their reflective comments in a way that each could be viewed in relation to each other without having to switch between data sets. This was achieved in a two-step process of compiling the individual video recordings of each musicians' performance into multiscreen clips, and then identifying instances of musical interaction, related performative gestures and musicians' reflective comments. These were then entered into a data table. Figure 8.2 illustrates screenshots of multiscreen videos of each case study performance.

The data table for each case study contains a chronological development of the melodic, and timbral attributes of the improvisatory interaction along with other related components such as sequentiality and simultaneity (call and response), motivic exchange and development, texture, etc. It also documents associated

Fig. 8.2 Multiscreen video clips of three case studies featuring dispersed musicians improvising in the telematic interface, eJamming

gestures involved with the production or manipulation of sound, as well as the musician's reflective comments about their perception of the interaction at these given points. This provides a global view of the interaction as it evolved over a 40-min period (Table 8.1).

8.4.3 Analysis

The analysis began by examining salient instances of improvised melodic interaction in the multi-screen screen video clips. This was then cross-referenced with related information from the data table such as the melodic or timbral nature of exchanges, associated gestures and the musicians' verbal reflections of these instances. The data table also provided additional information such as patterns of meter (rhythmic pulse), and harmonic development that as semiotic resources contribute to representation and meaning in the interaction. The VCR transcripts yielded much information about how the musicians perceived their interaction at these specific points, and it is only by drawing relationships between all of these interactive components that a thorough analysis was carried out.

The selected example as illustrated in the table above, is an 8-min section beginning in the opening minutes of case study II, and features Iranian *ney* player Sina Taghavi (ST), and guitarist and focus musician Michael Hanlon (MH). It was performed from separate locations at the University of Technology, Sydney. The musicians did not know each other or meet before hand. While geographic distance is not a factor, the study is designed to emulate the circumstances in which a collaboration of this nature takes place. ST arrived in Australia from Iran in the previous 12-month period and for the purposes of this research fulfilled the criteria of an expert Persian musician.

The example includes the instrumental warm up as the musicians started to interact while final line checks were completed. It then traced the developing interaction throughout the improvisation and includes a more detailed examination of interaction between 5:00–8:10 on the timeline.[3]

An overview of the entire 8-min section revealed that the melodic interaction between *ney* and *guitar* began in a tentative call and response (sequential) pattern,

[3] The clip can be viewed at http://youtu.be/ydgPf3l4IlA

Table 8.1 This data table is indicative of the dataset developed from the coding of the session, and also includes excerpts of interview transcripts obtained from the video-cued recall session. The data table is abridged due to space requirements, but time period 5:08-6:28 (marked in bold) is an unabridged example of the type of data that is obtained for every time period listed. Case study participants are *MH* guitar, *ST* ney. Present at the video-cued recall session were *RM* researcher, *OT* translator and *AT* Persian musicologist

Timeline	Interaction	Melody	Rhythm	Key	Timbre	Gesture	Musician comments
0:00–0:50	Sequential (Seq)	Detailed description	Unmetered	E minor	Det. description	Det. description	Interview transcript
0:50–2:24	Simultaneous (Sim)	Detailed description	4/4	E minor	Det. description	Det. description	Interview transcript
2:44–3:34	Musicians Introduction	Detailed description		Musicians Inroduction	Det. description	Det. description	Interview transcript
3:35–4:28	Sim/Seq	Detailed description	4/4	C# minor. Some intonation issues with ney in lower register.	Det. description	Det. description	Interview transcript
4:28–5:08	Sim	Detailed description	4/4	E minor	Det. description	Det. description	Interview transcript

(continued)

Table 8.1 (continued)

Timeline	Interaction	Melody	Rhythm	Key	Timbre	Gesture	Musician comments
5:08–6:28	**Sim**	***Guitar* intiates descending chordal sequence with soft finger plucking, over which ney plays emotive melody that becomes breathy.**	**4/4**	**C# minor**	**reverbed *guitar* breathy *ney***	**Selection gesture: 6:01 MH uses pick again for distinct plucked sound. ST: Parametric modification gesture - using lips to create breathy texture**	**RM: (5:57) Can you tell me what you were thinking at this moment? (ST Translation)** **AT: not a regular pattern. OT: He was trying to get out of the regular pattern, to bring out new sounds of the instrument, out of the mould it is accustomed to, the traditional mould.** **RM: Was that part of that finger gesture (pointing to part of the video) on that section of the instrument. (Translation)** **OT: He was trying to be atmospheric and that was the feeling that he was getting from the guitar player so he wanted to create an atmosphere.** **RM: Can you describe what that gesture is? ST: illusion** **OT: it is an atmosphere of illusion AT: not a clear scene for this, it is moody, blue** **OT: Hazy, it is a response to the guitar ST: Yes I just got it from the guitar player**
6:20–8:14	Sim return to Seq	Detailed description	4/4	A minor	Det. description	Det. description	Interview transcript
…	…	…	…	…	…	…	…
26:00–27:30	Seq	Detailed description	3/4 unmetered	A minor	Det. description	Det. description	Interview transcript
27:32–29:38	Sim/Seq	Detailed description	Unmetered	A minor	Det. description	Det. description	Interview transcript
30:15–33:38	Seq/Sim	Detailed description	4/4 Unmetered	A minor	Det. description	Det. description	Interview transcript
35:57–37:00	Sim/Seq	Detailed description	4/4 Unmetered	A minor	Det. description	Det. description	Interview transcript
37:40–40:50	Seq/Sim	Detailed description	4/4 Unmetered	A minor	Det. description	Det. description	Interview transcript

MH refers to the guitarist, *ST* refers to the Persian *ney* player, *OT* refers to the translator and *AT* refers to the musicologist

which increasingly resulted in overlapping (simultaneity). The interaction in this section mirrored the entire 40 min improvisation in that the melodic interaction based itself around small interval ranges and repeated melodic lines that emerge at different sections of the improvisation, sometimes transposed or modulated to different keys. Within the first 30 s of the improvisation, the guitarist played an ascending conjunct melodic line that was then imitated by the *ney* player. This call and response melodic imitation acted a meeting point for both musicians who comment on it within the first 3 min of their video cued recall session.

Guitarist MH,

> I was just trying to feel it here and see where he was at and trying not to play too much. So it was a kind of floating about looking for notes

Ney player ST translated by an interpreter,

> It was a new experience with the guitarist, it was a strange feeling and environment, some moments he would feel really close and some moments he felt really far away.

What the musicians were expressing was their perception of each other's presence in the musical space. MH's expression, "I was just trying to *feel* it here and see where he was at", and as ST comments, "some moments he would *feel* really close and some moments he *felt* really far away" are indicative of the adjustments that the two networked musicians are making to interact in the telematic and non-visual encounter. Indeed, it is their concept of embodied co-located musical interaction that is structuring their creative engagement in networked interaction as applicable to the MUSICAL LANDSCAPE metaphor (Johnson 2007). This early encounter also illustrated an evolving familiarisation between both participants as the melodic dialogue develops from sequential to simultaneous interaction.

There were some apparent differences in intonation (tuning) that occur and then diminish over time. While the *ney* in this study is tuned to an equal tempered E, the scales that it uses combine tetra chords (containing quarter tone intervals that form a perfect fourth) in the upper and lower registers. Explaining how this was occurring, Iranian *tar* player and musicologist AT who was present in the VCR session's states, "the higher tetra chords exist on guitar, but the lower ones don't […], which is why you can hear it as being out of tune". This formed an important part of the adjustment that both musicians make as they attenuate their playing in the early stages of the improvisation.

As the interaction moved from call and response (adjacency pairs) to increasing overlapping playing, or as Tannen (1992), would argue moving from "report talk" to "rapport talk" (cf. Van Leeuwen 1999, p. 68), the improvisation became more fluid, indicating the growing musical relationship between the two musicians.

The data table illustrates how the harmonic base that underscored the melodic interaction moved between A minor, E minor and C# minor for the duration of this whole section.

At 4:53 MH reached over to his effects unit in to change and lengthen the reverb setting, and at 5:08 he placed his guitar pick on the table to achieve a *softer* string picking sound for the next section of the interaction. These gestures set the timbre of the *guitar* sound, which implicitly suggested the atmosphere for the following section. MH then began plucking slow descending ostinato (repeating) arpeggio

lines in A minor that created a base for ST to play the *ney* over. This chordal and melodic interaction was initiated in small (conjunct) intervals that as the interaction developed became wider and more expressive. At 5:38 ST manipulated the timbre of the *ney* through a combination of breathiness, trembling lip movements and shaking of the instrument, which created an intimate, vibrato like sound from the instrument. He also articulated the notes with a legato (gentle attack) and longer durational phrasing. What can be extrapolated from this is that the combination of the guitarist playing soft timbral (reverbed) descending tonal patterns triggered a response from the *ney* player, who then emulated similarly timbral qualities from the techniques described above. Asked about the his finger and lip gestures, ST (*ney*) states,

> I was trying to be atmospheric and that was the feeling that I was getting from the guitar player, so I wanted to create an atmosphere.

As ST comments, he was able to perceive a combination of the guitar changing timbre from a sharp or more percussive plectrum sound to softer finger plucking and descending ostinato patterns, which he uses to develop his response.

These combinations of amplitude, timbre, descending pitch contours, note articulation and duration are well established parameters of communication of emotion in music, and have been rigorously defined from empirical studies of "cue utilization in performers communication of emotion in music" (Juslin and Sloboda 2010, p. 463). While studies of the communication of emotion in music to date are based on collocated music performance, it is argued that these same attributes are paramount to representation and meaning in networked improvised music performance. In the absence of visual cues, they become important signifiers for networked musicians to communicate and respond to in networked interaction.

Demonstrating another variation of this at 6:25, the improvisation came to a brief resting point, and MH performed a gesture of adjusting the level of delay on the *guitar* from his effects unit. ST then initiated the following interaction on the *ney* by moving up a register and beginning this next section by replaying a melody that emerged in the opening few seconds of the improvisation at 0:02. MH responded to this on *guitar* by voicing a higher pitched, wider range melody by increasing the pitch range of the accompanying ostinato chord pattern in E minor. This section of interaction then concluded by returning to the tonic at 7:40 as the players dropped back down to the lower octave in an imitative call and response on the same 3-note ascending melodic pattern that they started the segment with.

8.4.4 Findings

A summary of the analysis in this research reveals that networked musicians comprehend improvisatory interaction through a blend of metaphorically structured perception and embodied auditory imagination. They perceive significance in patterns of sound as a gestalt, which then form the imaginative structures on which they base their collaborative approaches. This was illustrated in a number of examples where musicians refer to the height, depth, or motion of another musician's sound, and the ways in which this influenced their musical responses, such as playing "underneath"

a perceived height in timbre, or to "play catch up" with a faster rhythm cycle by marking the pulse patterns. The musicians' longer-term strategies developed through iterative stages of the interaction as the result of recalling previous musical (melodic, timbral and rhythmic) events. Repetition of melodic motifs was used to create a sense of form, or to seed new musical material from sections of musical deconstruction. Instrumental gestures such as breath, lip and finger positions were also employed to elicit timbral variation, or attenuate differences in intonation.

The key approaches that emerged from both studies are as follows:

- Extended note durations in adjacency pairs (call and response), which focussed on the timbral nature of sound in the early stages of the improvisation. This provided a basis on which musicians felt able to begin to contribute to the interaction.
- Sequential (layered) interaction developed as harmonic accompaniment and emergent melodic motifs. This occurred as musicians' familiarity with each other developed.
- Rhythmic and melodic repetition occurred in later stages of the improvisation where musicians often recalled musical events that emerged in the beginning of the improvisation. This was done to augment, or refocus the improvisation.
- Rising and falling harmonic and melodic progressions signifying building tension and climax, which then transitioned to release and relaxation leading to a deconstruction of musical material returning to extended note durations with a focus on the timbral nature of sound.

8.5 Conclusions

While these approaches may share similarities to those that musicians use in co-located improvisatory scenarios, without the signifiers of presence (eye contact, facial expression and body language), they illustrate the efficacy of experiential metaphor in replacing these communication mechanisms in the minds of the musicians. The result is that while interactive approaches may be similar, the pervasiveness of metaphor in comprehending interaction enables an outcome for the networked musician where they have an opportunity to learn and develop their practice with other musicians with whom they would never likely have met.

For practitioners and researchers alike, the networked musical experience remains an elusive concept, and by its nature engenders more visceral verbal accounts in which metaphor is most often called upon to describe the experience. In this sense experiential metaphor provides a scaffold for an evaluation of adaptability in networked interaction, and as in Candy's criteria for evaluation (Candy 2014, p. 41), "purposeful" strategies behind the manipulation of sound parameters become the primary criteria for assessing musicians approaches to their interaction.

The evaluation of collaborative interaction through a social semiotic perspective, and metaphorically structured perception as outlined in Mills' framework make it potentially applicable not only other tele-collaborative domains but also a variety of digitally mediated interaction. It illustrates an interdisciplinary approach to gathering and assessing data that require it to account for actions of practice augmented by the

qualitative analysis of reflective experience. While this is a feature of many of the approaches in this book, it is the interpretation of these two components through image schematic structures that provide artists and researchers with an additional tool for interpreting reflective experience in their specific discipline.

References

Berliner PF (1994) The infinite art of improvisation. University of Chicago Press, Chicago/London
Bryan Kinns N (2014) Mutual engagement in digitally mediated public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 123–138
Caceras JP, Iyer D, Chafe C, Wang G (2008) To the edge with China: explorations in network performance. Paper presented to the ARTECH 2008, 4th international conference on digital arts, Portuguese Catholic University, Porto, 7–8 Nov 2008
Candy L (2006) Practice based research: a guide. Creativity and cognition studios report V1.0. November: http://www.creativityandcognition.com/content/category/10/56/131/. Accessed 9 Aug 2013
Candy L (2011) Research and creative practice. In: Candy L, Edmonds E (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon, pp 33–59
Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48, 41
Coker W (1972) Musical meaning: a theoretical introduction to musical aesthetics. Collier-Macmillan, Cambridge
Cumming N (2000) The sonic self: musical subjectivity and signification. Indiana University Press, Bloomington
Gotyemusic (2013) Gotye Somebodies: a Youtube orchestra. Video recording. Viewed 14 Mar 2013. http://www.youtube.com/watch?v=opg4VGvyi3M&gt
Csikszentmihalyi M, Csikszentmihalyi IS (1993) Family influences on the development of giftedness. In: The origins and development of high ability. Wiley, Chichester
Hutchins E (2005) Material anchors for conceptual blends. J Pragmat 37(10):1555–1577
Johnson M (2007) The meaning of the body: aesthetics of human understanding. University of Chicago Press, Chicago
Klemmer S (2010) About cognitive linguistics. International Cognitive Linguistics Association website. Viewed 12 Mar 2010 http://www.cognitivelinguistics.org/cl.shtml&gt
Kress GR, Van Leeuwen T (2001) Multimodal discourse: the modes and media of contemporary communication. Arnold/Oxford University Press, London/New York
Lakoff G, Johnson M (1980) Metaphors we live by. University of Chicago Press, Chicago
Lindstrand F (2010) Interview with Theo van Leeuwen. Des Learn 3(1–2):84–90
Machin D, Mayr A (2012) How to do critical discourse analysis: a multimodal introduction. Sage, London
Meyer LB (1956) Emotion and meaning in music. University of Chicago Press, Chicago
Omodei M, McLennan J (1994) Studying complex decision making in natural settings: using a head-mounted video camera to study competitive orienteering. Percept Mot Skills 79:1411–1425
Raingruber B (2003) Video-cued narrative reflection: a research approach for articulating tacit, relational, and embodied understandings. Qual Health Res 13(8):1155–1169
Sloboda JA, Juslin PN (2010) Music and emotion: theory, research, applications. Oxford University Press, New York
Symphony (2010) Youtube symphony orchestra. Video recording. Viewed 14 Mar 2013 http://www.youtube.com/watch?v=LnKJpYGCLsg&gt
van Leeuwen T (1999) Speech, music, sound. Palgrave Macmillan, London

Chapter 9
Mutual Engagement in Digitally Mediated Public Art

Nick Bryan-Kinns

Abstract This chapter examines the socially constructed responses that emerge through interaction with works designed for collective experience. The focus here is on the moments of creative spark that emerge between people as they mutually engage through collective art forms. These art forms exploit digital social infrastructure to create socially empowering public digital art forms where the emphasis is on the enjoyment of being creative together rather than art per se. The fluidity of such interaction allows for micro-creativity: that is, digitally mediated creative activities which can be carried out as a number of fleeting collaborative interactions over an extended period of time, and in a wide range of interaction contexts from galleries to mobile phones. The public art in these situations is in the experience, not the physical artefact itself which often does not exist in any case. In this chapter, we are particularly interested in experiences in which people actively construct public art within the boundaries created by the artist. In particular, where people both experience and contribute to the creation of the collective artwork. The key to evaluating the experience of collective artworks is to identify points at which people mutually engage in micro-creativity together. This involves identifying the birth, development, and sustenance of micro-ideas, or memes as they propagate through the socially constructed experience. We first outline which it might mean to be mutually engaged with other people, and then go on to explore the concept of micro-creativity and the emergence of memes. Finally, we describe visualisations which help us to explore the value judgements of participants engaged in micro-creativity through memetic evaluation.

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9.1 Introduction

The subjective and deeply personal nature of art appreciation makes evaluating any one person's response to artworks not only problematic, but also counterproductive, destroying the very visceral experience that is under the microscope. There can be no rules about what makes 'good' art (cf. Kandinsky); instead, this chapter examines the socially constructed responses that emerge through interaction with pieces designed for collective experience. The focus here is on the moments of creative spark that emerge between people as they mutually engage through collective art forms which exploit new forms of digital social infrastructure to create socially empowering public digital art forms where the emphasis is on the enjoyment of being creative together rather than art per se. The fluidity of such interaction allows for *micro-creativity* – digitally mediated creative activities, which can be carried out as a number of fleeting collaborative interactions over an extended period of time, and in a wide range of interaction contexts from galleries to mobile phones. The public art in these situations is in the experience, not the physical piece itself which often does not exist in any case.

Digitally Mediated Public Art uses technology to create situations in which multiple people interact in an artistic experience. In this chapter, we are particularly interested in experiences in which people actively construct public art within the boundaries created by the artist – where people both experience and contribute to the creation of the collective artwork. The key to evaluating the experience of collective artworks is to identify points at which people *mutually engage* in micro-creativity together. This involves identifying the birth, development, and sustenance of micro-ideas, or *memes* as they propagate through the socially constructed experience. In this chapter, we first outline what it might mean to be mutually engaged with other people, and then explore the concept of micro-creativity and the emergence of memes. Finally, we explore visualisations which help us to explore the value judgements of participants engaged in micro-creativity through *memetic* evaluation.

9.2 Mutual Engagement

Mutual engagement occurs when people creatively spark together, lose themselves in their joint action, and arrive together at a point of co-creation (Bryan-Kinns and Hamilton 2009; Bryan-Kinns 2012). It is imprinted in the moment-by-moment contributions of people when they are engaged in micro-creativity. In collective art, the artist creates pieces which provide the opportunity and boundaries for participants to mutually engage with each other as part of the experience of the work. Points of mutual engagement are inherently difficult to identify and measure as the act of reflecting on mutual engagement undermines some of the characteristic qualities of the experience such as spontaneity. Furthermore, as the points of interaction are

fleeting it is difficult to assign value or worth to individual points of micro-creativity. The most important characteristic of mutual engagement is that it involves engagement with both the collective artwork *and* with the other people who are engaging with the work. Engagement is the point at which people feel that they are able to change and appreciate changes in the artwork (cf. Douglas and Hargadon 2000) – it involves appreciation of possible contributions and anticipation of their outcomes. This is similar to descriptions of flow (Csikszentmihalyi 1991) that is, optimal experiences in which "attention can be freely invested to achieve a person's goals" resulting in a merging of action and awareness and consequent lack of self awareness and distortion of sense of time. Collective artworks do not usually have explicit goals (e.g. to score the highest points, or perform an activity the quickest); instead, the artist creates experiences and opportunities which provide implicit goals such as making a funny picture, or creating a nice tune. In mutual engagement, people are engaged with the product at hand, and also with others in the collaboration (Bryan-Kinns and Hamilton 2009), which is similar to *group flow* (Sawyer 2003), but the focus is on the moment-by-moment interaction rather than experiences lasting hours or days.

Understanding mutual engagement in collective art involves identifying points at which there is:

- Evidence of engagement with the collective artwork itself. For example, people's reports of feeling engaged with the output of the artwork, a high quality joint composition, focused contributions in the interaction, or demonstrations of skills and expertise in creating contributions.
- Evidence of engagement with others in the artwork. For example, more reports of feeling engaged with the group, coherent final joint products, making contributions close to other people, mutual modification of contributions, discussions of quality of the joint product, repetition and reinterpretation of others' contributions. Clearly these forms of engagement rely on people's skills and expertise with the digital mediation of the experience.

9.3 Mutual Engagement and Music

Music is an artistic activity which relies heavily on mutual engagement – the riffing and jamming on musical ideas generates new forms of creative expression which convey emotion without words or pictures. More importantly, music is a basic form of human expression found in all cultures: it is both a cultural expression and a result of personal creativity. Indeed, music making is fundamentally social, collaborative, and open in nature (cf. Titon 1996), whereas the Western Art Music tradition has typically focussed on high artistic and technical virtuosity. Music conveys emotion, and can transport us to different times and places. Digitally Mediated group music experiences allow for artistic creativity on many levels: as a participant who makes music within the experience, as the artist who creates the environment

for the experience, and as audience who may appreciate recordings and reuse of the music at a later point. Trying to differentiate between the composition of music, its performance, and improvisation is problematic (cf. Bowers 2002), and many practising musicians would argue that writing about music is counter-productive (cf. Laurie Anderson). However, by identifying the birth, development, sustenance, and propagation of musical ideas (or memes, cf. Dawkins 1976) in mutually engaging micro-creativity, we believe that we can begin to understand and evaluate the creativity that goes on in these collective art experiences, and this will help to inform the design and creation of future Digitally Mediated Public Art.

9.4 Micro-creativity

The emergence of new forms of digital social infrastructure including social networks such as Facebook and micro-blogging tools such as Twitter illustrate the populist potential of digital technologies to provide increased opportunities for collective creativity. These on-going creative activities where the emphasis is on the enjoyment of being creative with other people are referred to as *micro-creativity* and have the following features:

- Digitally-mediated creative activities
- Carried out as a number of fleeting collaborative interactions
- Happen over an extended period of time
- Take place through a wide range of digital mediation from desktop computers to mobile phones

For example, people use micro-blogging tools to play word games over periods of weeks, or to engage in collective (micro) drawing by uploading and iteratively editing small shared sketches, or even to programmatically create music. Similarly, artists have used and subverted social networking to create digitally mediated collective art works, which rely on micro-creativity between participants to socially construct the artistic experience.

Clearly different media and artistic intent foster different forms of memes, from musical memes to graphical sketches or even new forms of dance. As discussed above, music is particularly interesting as an art form as it is a collective experience without words or visual images; it requires skill to produce beautiful music, yet anyone can be emotionally touched by music. In this way, music is both inclusive and exclusive, and acts as a cultural memory. Moreover, digital technologies now empower us with the ability to make and share music wherever we may be, and provide unique opportunities to explore new forms of music making.

In contrast to 'telematic' musical experiences (e.g. Chap. 8 ("The Network Unveiled: Evaluating Intercultural Musical Interaction"), Mills and Beilharz 2014), in micro-creativity we are interested in new forms of music making in collective art experiences which extend over longer periods of time and may not require highly skilled, virtuosic performances, as illustrated by some of the developments in the

field of New Interfaces for Musical Expression (NIME; Poupyrev et al. 2001). For example, Ocarina (Wang 2009), and Daisyphone (Bryan-Kinns 2004) are mobile phone Apps for social music making. Ocarina supports micro-creativity by allowing people to create short pieces of music using a simple four key interface. These musical contributions are then shared with a global community of users who can tag and rate them. In contrast, Daisyphone allows direct co-editing of short loops of music, but little support is provided for social interaction beyond the music.

9.5 Exploring Mutual Engagement in Micro-creativity

In order to explore mutual engagement in micro-creativity, the author has developed and studied a number of collective music making software environments. These systems provide a shared environment in which the seeding and evolution of memes and mutual engagement can be studied between people in the same place, and across the world. It is important to note that these are not Public Art pieces per se, but rather systems in which people can create music together over time, and their actions and reactions be observed, analysed, and interpreted to help understand how the interactive characteristics of the shared experience change the micro-creativity. These understandings could be used to inform artists' creative practice and reflections on collective and public art. The systems provide a peek into the future of what interactive public art could be experienced as. This contrasts practice-led research such as (Costello and Edmonds 2007) where the emphasis is on reflection on the artists' practice and technology: these systems place the emphasis on exploring how micro-creativity emerges and is sustained which we argue is vital to socially constructed artistic experiences.

The key environments discussed in this chapter are Daisyphone and Daisyfield (referred to collectively as Daisy*). Both environments allow co-editing of short loops of music by co-located and online groups of users through web and iOS interfaces in focused sessions or over extended periods of time. Daisyphone was launched in October 2003 (Bryan-Kinns 2004), and at launch it received between 4 and 18 players per day from all over the world. Logs of interaction have been collected since its launch, and there are now 160 Mb of log files, or approximately ten million individual interactions.

In Daisyphone, there is a shared loop of music (5 s; 48 beats) chosen to be the most reduced and constrained piece of shared creativity that still contains scope for expression, which can be edited by up to ten networked people at the same time. Each person can create notes using four different voices, can edit any notes, and can draw on a shared drawing area to allow for some social communication beyond the music. Figure 9.1 illustrates Daisyphone in use on an Apple iPhone; the score is represented by the circle of dots, and the currently played set of notes is indicated by the grey line radiating from the centre which rotates clockwise over the period of 5 s. Shapes represent different kinds of sound (ambient electronic sound palette in C major scale consisting of bass, lead, wash, and percussion). The shapes in the

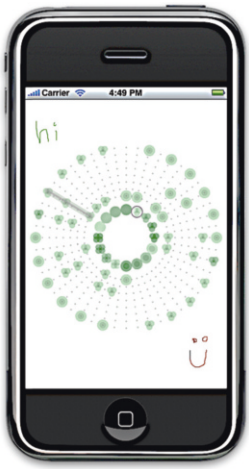

Fig. 9.1 Daisyphone

Fig. 9.2 Daisyphone co-located

centre allow participants to select which sound type and volume they create notes with. Colours can be assigned to people to provide a sense of identity as discussed later. Figure 9.2 illustrates two co-located people using Daisyphone at the same time.

Daisyfield is a development of the Daisyphone concept which allows multiple loops (i.e. Daisys) to be played concurrently, and for participants to arrange their Daisys in a two dimensional space. Again, a single shared score of 48 beats is created form the individual Daisys, and each participant hears the same audio output. Figure 9.3 illustrates the Daisyfield interface with three Daisys shown, the larger one is opened for editing. The aim of this interface is to provide a richer musical and communicative user interface for exploring mutual engagement in micro-creativity.

By undertaking controlled studies in laboratory situations we have studies the interaction between people engaging in group music making with Daisy* in

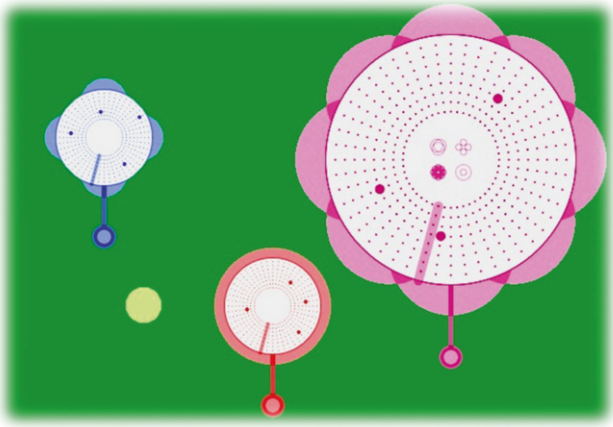

Fig. 9.3 Daisyfield

co-located and online settings. We correlated the results of these experiments with a reliable questionnaire for identifying mutual engagement in interaction (the Mutual Engagement Questionnaire (Bryan-Kinns 2012)) to show the following (see Bryan-Kinns 2004, 2011, 2012; Bryan-Kinns and Hamilton 2009):

- Providing cues to identity increases mutual engagement between participants
- Providing additional communication channels beyond the shared music increases mutual engagement
- More focussed interaction indicates mutual engagement between people, rather than more interaction per se
- Persistent music supports learning; transient music supports skilled expression
- When mutually engaged, participants move their music closer to each other and produce better quality music

Whilst these results are useful and significant, they are the result of controlled laboratory studies which do not give us an insight into the experiential aspects of mutual engagement in public art. They help us to design interaction which is more mutually engaging, but they do not expose the underlying experience of art in public, nor do they explore the micro-creativity over extended periods of time. Instead, we need to take a more observational approach to understanding the mutual engagement. Observing participants in co-located settings such as museums, or even specially created observation spaces in museums such as Beta_space (Turnbull and Connell 2011) would provide more insight into the co-located experience, but not the online experience over extended periods of time. Indeed, research has examined how musical ideas are generated and built on by participants in group music improvisations (Healey et al. 2005), using Video Cued Recall techniques as discussed in Chap. 3 ("Evaluation and Experience in Art", Candy 2014), but these would be impractical for use over extended periods of online activity.

Instead, what we are interested in is identifying the birth, development, sustenance, and propagation of musical ideas (or *memes*, cf. Dawkins 1976). This gives us a window into the experience of public art on land, online, and over extended periods of time, identifying what people make within the artists' boundaries, exploring how people value each others' micro-creativity in the collective artistic experience.

The rest of this chapter shows how memes can be tracked over extended periods of time through case studies of 10 years of public online music making. Extensive studies show that mutual engagement relies on shared awareness of collective creativity, and that focussed interaction results in the most compelling and engaging memes. Subjective measures of engagement and enjoyment have also been shown to be correlated with coherent and high quality contributions to the shared experience. Examining memes allows us to:

- Observe "art as experience" as discussed in Chap. 3 (Candy 2014) – observing the fundamental evolution of the art within the boundaries set by the artist.
- Expose participants' evaluation of their own, and others' contributions to the collective art – appraising and judging the worth of memes cf. judging worth discussed in Chap. 3 (Candy 2014) – to understand which memes participants judged to be valuable enough to repeat, modify, and repurpose.

9.6 Visualisations of Memes

Observing the evolution of memes over times requires visualisations which collapse the interaction across space and time. These visualisations expose the inter-personal micro-creativity and allow us to observe how memes cohere in mutually engaging experiences, fragment as the engagement decreases, and can be tracked over time and space.

The first step in tracking the birth and growth of memes in micro-creativity is to be able to algorithmically identify them in the on-going interaction. This is no mean feat as micro-creativity extends over time and involves multi-faceted interaction. Identifying and tracking memes by hand would take an impractically long time. Instead, we use pattern matching approaches to discover musical structure and repeating patterns (cf. Dannenberg and Hu 2002), using the following heuristics as the basic characteristics of musical memes:

- At least three notes (not pauses), and
- No more than two pauses between notes.

From this definition of musical memes we can collapse the data across the following dimensions to provide useful visualisations of the mutually engaging interaction:

- Time: when the meme was made and also when it was modified. Varying the granularity of the time dimension allow memes to be tracked as they develop.

Fig. 9.4 Development of a meme

- Participant: who started the meme, and who contributed to its on going creation. More co-editing indicates greater mutual engagement between participants.
- Spatial location: where the meme is located in the user interface. Closer memes indicate more mutual engagement (Bryan-Kinns 2012).
- Musical range of the meme: whether the meme is monophonic or polyphonic, and whether there is a wide dynamic of notes in the meme.
- Density of musical meme: what percentage of musical pauses are used in the meme. This allows us to track musical style in the music.

Removing the spatial dimension, and laying memes out sequentially allows us to visualise their development over time. Figure 9.4 illustrates the development of a musical meme by one participant. The meme starts from a sequence of two pairs of notes in the leftmost box, after four iterations, the meme has become an interesting musical meme composed of a three descending notes followed by three rising notes.

Figure 9.5 illustrates the memes identified in 15 min of interaction between four participants using Daisyfield. This is fairly representative of the typical progression of memes in the extensive studies undertaken. In the figure, several memes are seen emerging (time is laid out from left to right, top to bottom), for example the meme illustrated in Fig. 9.4 is clearly seen in Fig. 9.5 as it develops and is repeated. Figure 9.5 also shows the persistence, or popularity (as participants can delete notes they are unhappy with), of certain memes such as the descending sequence of notes, which is repeated throughout most of the 15 min interaction.

Figure 9.5 also illustrates points at which participants complement each other's contributions and co-create musical memes together. For example, on the fifth row down the green and red participant co-create a musically harmonious meme together as summarised in Fig. 9.6. This shows high levels of mutual engagement as the participants feed off each other's contributions. Other examples are shown in the second and third rows to the bottom of Fig. 9.5. These examples are important as they illustrate participants' evaluation of their own, and, importantly, each other's contributions, by assessing the value and worth of contributions participants co-create the memes over time.

Such visualisations can also be applied to co-located Public Art such as Digital Live Art (Sheridan 2006), for example iPoi (Sheridan et al. 2007) in which participants were observed developing and propagating interaction memes of 'trading pauses' and 'emphasising beats' through the use of technologically augmented poi. These interaction memes were not designed for, but instead were

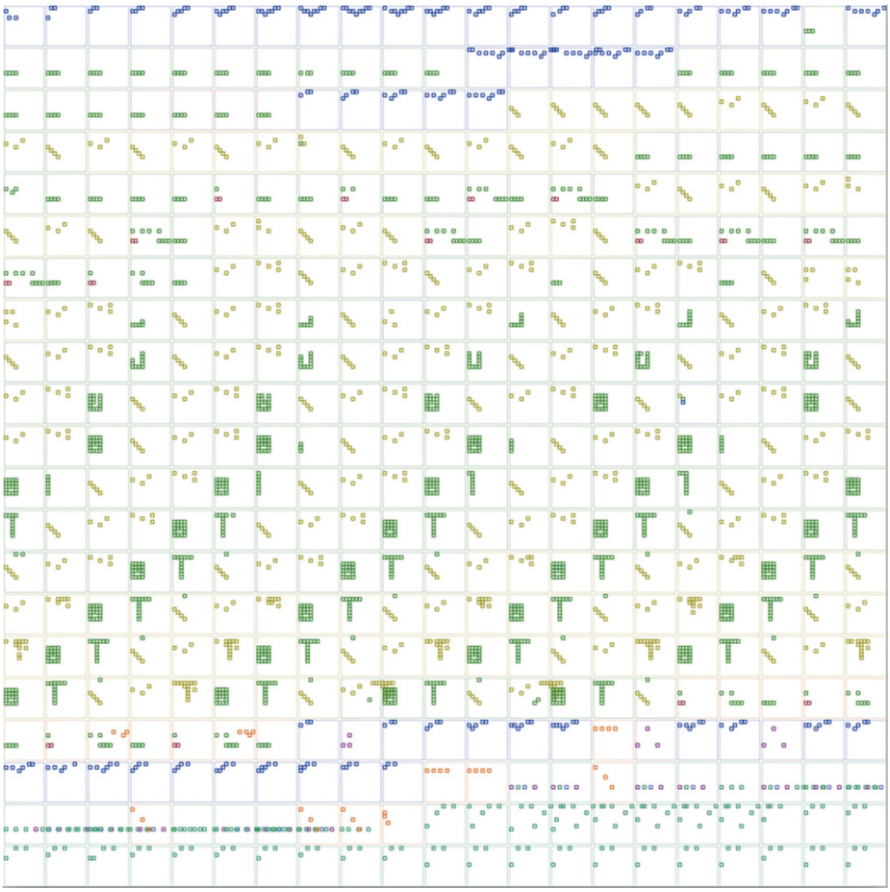

Fig. 9.5 Typical 15 min of four people's memes

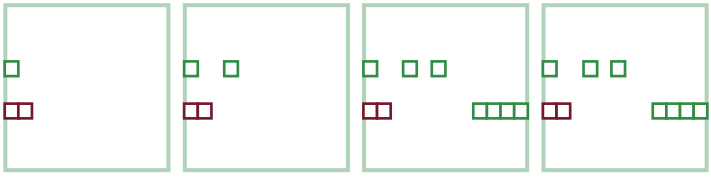

Fig. 9.6 Complementary development of meme

observed emerging in the interaction between skilled participants. Tracking the development and sustenance of such memes would be an ideal application of the visualisations above.

However, these visualisations quickly become overly complex when larger data sets are examined. Instead we need to abstract away from the content of the meme,

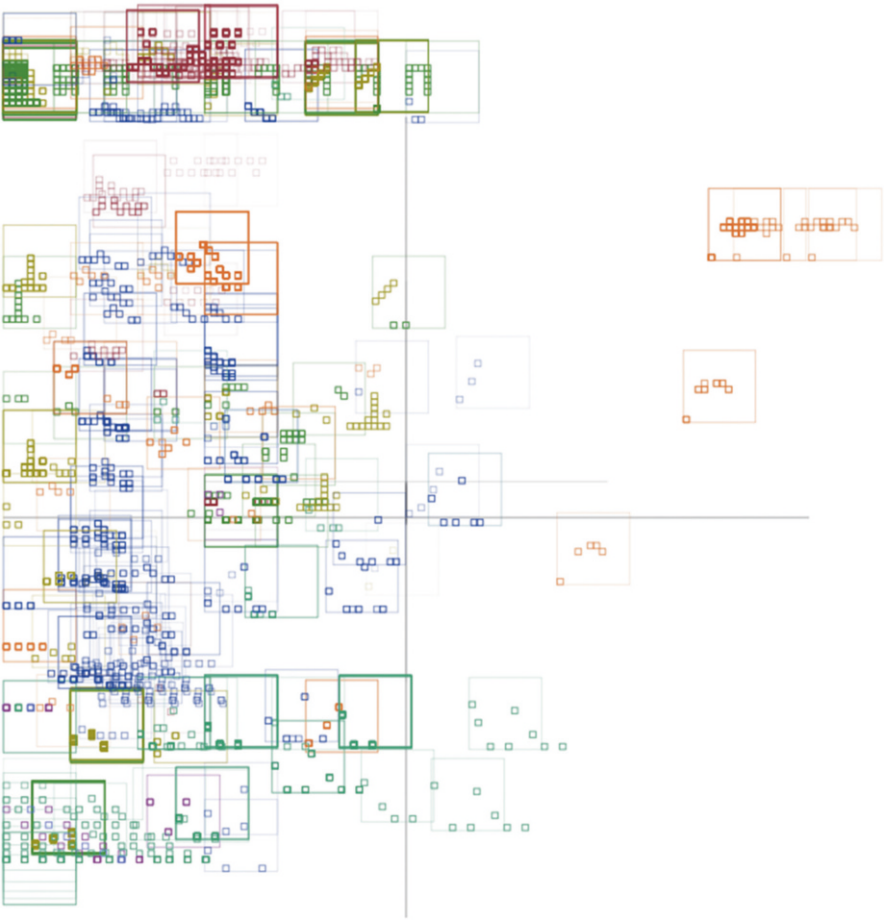

Fig. 9.7 Laying out memes by musical properties

and focus instead on the characteristic properties of memes. Musical features such as complexity and rhythm can be algorithmically identified and mapped to visual dimensions to provide a richer visualisation of the emergence of memes. Figure 9.7 shows the same set of memes illustrated in Fig. 9.5, but with x mapped to musical complexity, and y mapped to musical rhythm. This provides a visualisation which allows us to spot styles of musical contribution, and to identify whether these are tied to specific participants. In Fig. 9.7, it is clear that the orange participant has the most unique musical style – quite musically complex with only a few pauses in their memes, demonstrated by their memes being in the right side of the visualisation. The dark green participant predominantly made memes with no pauses (top left quadrant), whereas the light green participant predominantly made memes with half the beats as pauses (bottom left quadrant). Overall, it can be seen that most participants created quite monophonic memes (containing notes predominantly of the

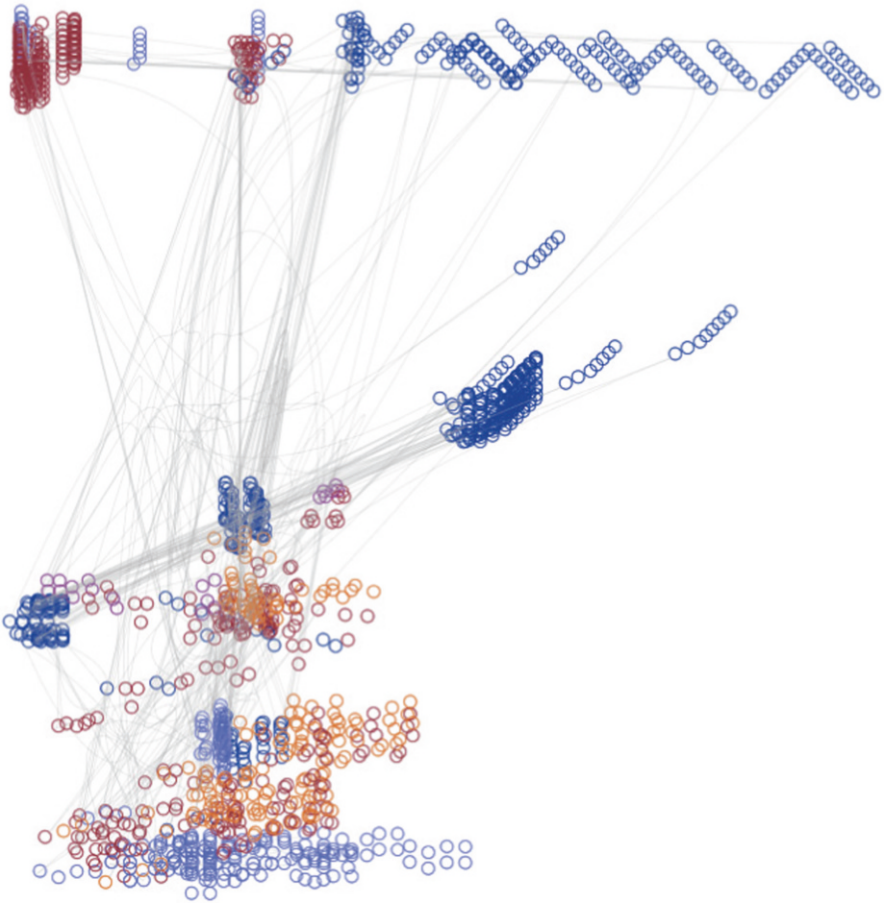

Fig. 9.8 Adding time to musical properties – group A

same pitch). This is may in part be use to the ambient nature of the music which may favour simple memes. It would be interesting to explore whether the same pattern is found with other musical styles, or other levels of musical experience of participants. The interesting aspect of such pieces of interaction is that we can see that participants are making different kinds of memes, and if we switch to spatial layout of visualisations, we see that they are making these contributions in different spatial locations, but at the same time. So, space and musical features are similarly differentiated between participants. The interactive nature of the visualisations allows us to easily explore such connections.

Whilst Fig. 9.7 illustrates the kinds of memes developed in a typical 15-min session, it has lost the sense of time, or, the development of memes. Figures 9.8 and 9.9 add to the visualisation of memes laid out by style by adding temporal connections between memes as grey lines connecting memes in temporal sequence. In Fig. 9.8, the grey lines indicate that there were frequent moves

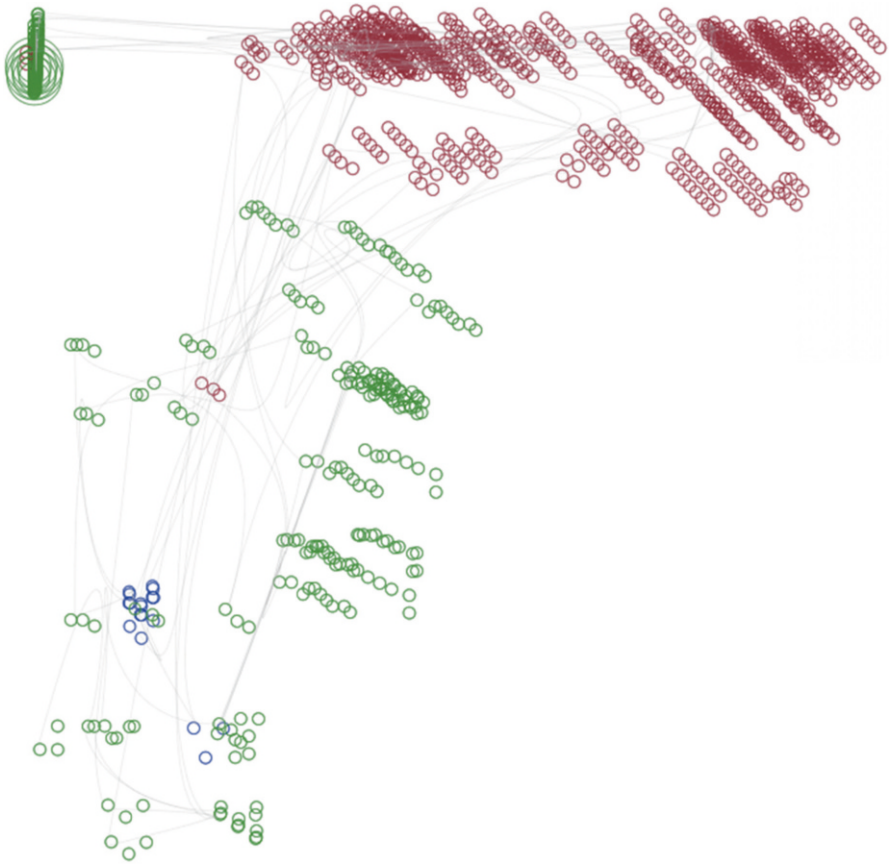

Fig. 9.9 Adding time to musical properties – group B

between memes of low rhythmical complexity (top of figure) to those with high rhythmical complexity (bottom of figure), for the group of participants. Most of the movement left-to-right in the figure (low musical complexity to high musical complexity) appears to be the work of the blue participant between their two main groups of memes. These two observations indicate:

1. That participants engaged in micro-creativity with different rhythmical patterns at the same time, some of which converged e.g. the red, orange, and light blue converge at similar rhythm and complexity at the bottom left of the visualisations. This indicates that three of the participants were mutually engaged and building on each others' contributions – using their value judgement to evaluate each others' contributions to inform their own contribution.
2. That over time the blue participant spent quite a bit of time experimenting with musical complexity which was not picked up by other participants. This indicates that one participant was engaged with his own personal activity (and the creative output), but not mutually engaged with others in the collective creativity.

In contrast, Fig. 9.9 illustrates the development of memes in a different group (B). In group A, each participant saw their musical contributions in a unique colour, whereas in Group B, all musical contributions were displayed in the same colour. Group B does not appear to converge on a shared musical style: the red participant focuses on simple descending sequences of notes, whilst the green participant explores more rhythmical musical structures. There are significantly fewer grey lines connecting the memes over the same period time as group A, indicating that participation was more turn-taking rather than overlapping. These observations from the visualisations support with the findings of previous research on the role of identity in mutual engagement (Bryan-Kinns and Hamilton 2009; Bryan-Kinns 2012), providing a richer, more explanatory account of the interaction.

These observations would lead us to investigate the interaction further and ask why one participant's experiments were not taken up by other participants, especially as the other three participants did converge on a particular musical style. It is a question of understanding participants' value judgements in their socially constructed musical composition. These value judgements are beyond the scope of visualisation – they require a more reflective evaluation technique, some akin to Video Cued Recall (Chap. 3) exploiting the interactive nature of the visualisations. The visualisations may provide a complementary source of data for evaluating telematic music making (e.g. Chap. 8) where rich video recordings of group music making could be enhanced by examining how musical memes propagate and develop across time. Similarly, musical memes could be automatically identified in technologically support group music making in co-located systems such as Polymetros described in Chap. 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings", Bengler and Bryan-Kinns 2014).

Tracing and visualising the trajectory of memes has parallels in the Human Computer Interaction domain with the understanding of Interaction Trajectories (cf. Blandford et al. 2001). In the HCI domain, we are interested in tracing how a single user navigates the possible interaction with a single device, and whether they take deviate from an ideal path. Interactive visualisations discussed in this chapter could be used to explore multiple users' individual trajectories projected into one time and space domain. This would allow us to identify common and reoccurring patterns of interaction through the clustering approaches discussed in this chapter. Moreover, the visualisations discussed in this chapter could be much more powerfully applied to multi-user interaction, in particular, large-scale multi-user interaction such as social media networks. Applying the memetic analysis and visualisation to twitter feeds and Facebook networks would provide a rich interactive view of how large numbers of people engage in micro-creativity, and how they mutually engage over extended periods of time. The memes in these situations would be words and images requiring different ways of identifying memes, but exploiting the same visualisation approaches.

Public Digital Art Evaluation often considers evaluation of the Art by Audience or Artist: see for example, Chap. 2 ("Human Computer Interaction, Experience and Art", Edmonds 2014). In contrast, mutual engagement is about understanding the interaction between people whether they are audience

members, participants, or artists. In this chapter, we have explored the mutual engagement between participants engaged in a public creativity activity, which provides an orthogonal, or counter-balancing evaluation of Public Digital Art. The visualisation approach could usefully be employed to understand how people engage with each other through physical interaction in the Tweetris experience (Chap. 11 ("Blending Art Events and HCI Research"), Reilly et al. 2014) and body positions could be interpreted as memes and visualised across time to help us understand the social elements of the piece.

9.7 Conclusions

This chapter explores how we can identify mutual engagement in collective art. We considered how this could be applied to micro-creativity in on-going interactive Public Art, and considered some visualisations of the birth, growth, and development of musical memes. Whilst the work in this chapter predominantly focuses on musical interaction, we argue that this fundamental form of interaction provides us with insights which could be applied to other forms of interactive Public Art such as Digital Live Art.

It is important to remember that by examining the inter-personal interaction that emerges in Public Art we remove ourselves from the question of what is 'good' art, and focus instead on what makes for mutually engaging experiences which touch our soul which, after all, is the purpose of art.

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References

Bengler B, Bryan-Kinns N (2014) In the wild: evaluating collaborative interactive musical experiences in public settings. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 169–186

Blandford A, Stelmaszewska H, Bryan-Kinns N (2001) Use of multiple digital libraries: a case study. In: Proceedings JCDL 2001. ACM Press, New York, pp 179–188

Bowers J (2002) Improvising machines. M.S. thesis, Masters in Music by Research, University of East Anglia, Norwich, UK

Bryan-Kinns N (2004) Daisyphone: the design and impact of a novel environment for remote group music improvisation. In: Proceedings of DIS 2004, Boston, USA, pp 135–144

Bryan-Kinns N (2011) Annotating distributed scores for mutual engagement in Daisyphone and beyond. Leonardo Music J 21:51–55

Bryan-Kinns N (2012) Mutual engagement and collocation with shared representations. Int J Hum Comput Studies 71:76–90

Bryan-Kinns N, Hamilton F (2009) Identifying mutual engagement. Behav Inf Technol 31(2):101–125
Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48
Costello B, Edmonds E (2007) A study in play, pleasure and interaction design. In: Proceedings of the 2007 conference on Designing Pleasurable Products and Interfaces (DPPI'07). ACM, New York, pp 76–91
Csikszentmihalyi M (1991) Flow: the psychology of optimal experience. Harper Collins, New York
Dannenberg R, Hu N (2002) Pattern discovery techniques for music audio. In: Proceedings of 3rd international conference on Music Information Retrieval (ISMIR), Paris, France
Dawkins R (1976) The selfish gene. Oxford University Press, New York
Douglas Y, Hargadon A (2000) The pleasure principle: immersion, engagement, flow. In: Shipman F (ed) Proceedings of hypertext 2000. ACM, New York, pp 153–160
Edmonds EA (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23
Healey PGT, Leach J, Bryan-Kinns N (2005) Inter-play: understanding group music improvisation as a form of everyday interaction. In: Proceedings of less is more — simple computing in an age of complexity. Microsoft Research, Cambridge
Mills R, Beilharz K (2014) The network unveiled: evaluating intercultural musical interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 109–122
Poupyrev I, Lyons MJ, Fels S, Blaine T (2001) New interfaces for musical expression. In: Tremaine MM (ed) CHI'01 extended abstracts on human factors in computing systems, Seattle, USA. ACM, New York, pp 491–492
Reilly D, Chevalier F, Freeman D (2014) Blending art events and HCI research. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 152–168
Sawyer KR (2003) Group creativity: music, theater, collaboration. Psychology Press, Mahwah
Sheridan JG (2006) Digital Live Art: mediating wittingness in playful arenas. PhD thesis. Computing Department, Lancaster University, Lancaster, UK
Sheridan JG, Bryan-Kinns N, Bayliss A (2007) Encouraging witting participation and performance in digital live art. In: Ball LJ, Sasse MA, Sas C, Ormerod TC, Dix A, Bagnall P, McEwan T (eds) People and computers XXI – design for life: proceedings of 21st British HCI Group annual conference, Lancaster, UK. Springer, Berlin, pp 13–23
Titon JT (1996) World of music. Schrimer Books, New York
Turnbull D, Connell M (2011) Prototyping places: the museum. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publishing, Faringdon, pp 79–93
Wang G (2009) Designing Smule's iPhone Ocarina. In: Proceedings of the international conference on new interfaces for musical expression, Pittsburgh

Chapter 10
The Role of Emotions in Art Evaluation

Chek Tien Tan and Sam Ferguson

Abstract Emotion is an important component in any evaluation of an artwork. Research into emotion is a growing field, and methods for evaluating emotions in artworks is an area where research is rapidly expanding. This chapter outlines the basic theories of emotion and develops an understanding of the state of the art in emotion evaluation for interactive digital art. The component process model of Scherer is discussed and then a number of examples of evaluation of emotion in interactive art are presented, including a closer look at video games as a form of interactive art.

10.1 Introduction

Emotions have a special place in human experience, as they are an important way that humans motivate themselves to interact with their environment and with the people around them. Emotions can obviously be triggered by sensual experiences: for instance, by seeing and hearing a baby crying. They can also be experienced after intellectually understanding a particular outcome: for instance, when you are overcharged on a restaurant bill, intense negative feelings might emerge resulting in a possible angry confrontation with the waiter. Emotions are, therefore, likely to be essential components of the understanding and experience of an artwork, and from that we propose that evaluation of art through emotions is likely to be a worthwhile endeavour.

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The investigation of the relationship between art and emotion is not new, and researchers have focused on emotion, cognition and the art object in many contexts. One of the paradoxes in studying emotion and art is the level of emotion that is generated in any discussion of the relationship between emotion and art. However, many investigations of art and emotion (see Sect. 10.5 below) have found that expressed emotion can be recognised extremely rapidly, and that emotions can be encoded and then successfully communicated by artists.

Nevertheless, emotions cannot be expected to encapsulate art experiences entirely. It is common to hear a description of an artwork as an expression of the emotions of the artist, but similarly, many artworks may also *not* seek to communicate particular emotions; nor should we expect that there is some direct causal relationship between emotion expression and art quality. Viewing art may result in the experience of a wide variety of specific emotions, but also in many other types of experience, perhaps conscious contemplation or memory recall. And so emotion only provides one angle from which to view the evaluation of art, albeit an important one worth investigating.

Generally speaking, in emotion research there tends to be little disagreement about art being able to *express* particular emotions, but much more about whether art can *induce* authentic emotions in the audience members or participants. This distinction has particular methodological implications; evaluating whether a particular emotion is *expressed* by an artwork can be as simple as asking a participant if they can recognize the emotion being expressed. However, to assess whether an emotion has been induced, one has to define what it means to authentically experience an emotion, as distinct from recognising it in an artwork. Some researchers have used self-report methods to assess emotion induction compared to emotion expression (e.g. Evans and Schubert 2008), while others have used significant change in physiological signals as evidence of authentic emotion experience (Krumhansl 1997).

Research into emotions is limited, however, by the domain in which it is applied. Usually, researchers will attempt to use artworks as 'stimuli' to explore particular aspects of emotional responses to art. Little research focuses on the use of emotional responses to investigate art itself, or even whether the emotional responses seen in laboratory investigations (whether recognised or induced) extend into real-world or ecologically valid contexts. This may be due to technological problems. Many of the emotion response methods are based around either interrupting the audience to request responses to questions, or through complex electrical sensors requiring significant physical stability. However, it does seem that while the experience of art in an emotional sense may be understood to some extent by lab-based research, even simple replications of the complexity of real-world art presentation (for instance, the effect of social context), have uncovered significant modifying factors (Egermann et al. 2011).

This chapter hence aims to highlight the usefulness of evaluating art experiences and artworks from the perspective of emotions. The following section starts by introducing the role of emotions in art.

10.2 What Are Emotions?

The idea of trying to define emotions is a notoriously thorny issue. Although the study of emotions is one of the oldest research areas in psychology, human emotions is a complicated concept with no lack of scholars in constant pursuit of redefining it in a multitude of ways. For instance, in 1981, Kleinginna and Kleinginna (1981) reported over a 100 emotion theories. It would therefore be overly ambitious for us to try to define emotions in full here. Instead, this section aims to provide an overview of the popular theories that have evolved till today, as a background for our discussions on modern emotion research in art.

Starting from classical theories of emotion, the James-Lange theory (developed independently by William James in 1884 and Carl Lange in 1885) states that physiological arousal precede emotions (Cannon 1927). James and Lange stated that a person would first experience a physiological change (i.e. a bodily reaction like sweating or smiling), which then instigates the nervous system so that the brain generates an emotion felt by that person. Later in the 1920s, Cannon and Bard showed evidence that challenged the fundamental notions in the James-Lange Theory, claiming that emotions are instead felt first, followed by physiological responses (Cannon 1927). This led to the Cannon-Bard theory: i.e. emotions are derived from subcortical centres, a theory that eventually replaced the James-Lange theory. Following the work by Cannon and Bard, Stanley Schachter and Jerome Singer (1962) went on to show that emotion is a function of both cognitive factors and physiological arousal. They proposed that a person uses contextual information from the immediate situation in order to qualify the physiological arousal. This became the Schachter-Singer theory, alternatively known as the two-factor theory of emotion (Schachter and Singer 1962).

In more recent times, Izard (1977) proposed the emotion triad: comprising subjective feelings, physiological activation and motor expressions. This triad became the foundation for several other prominent works which includes Scherer's component process model (1984), which added the cognitive appraisal and behavioural tendency components to the triad, as well as Lazarus (1991) who added the conative component (i.e. a mix of behavioural tendency and motor expression).

Far from being idiosyncratic experiences of individuals, society heavily regulates emotional experiences, through the use of taboos, prohibitions, and other group-based methods of control. Indeed, emotional responses in audiences can be predicted so easily that they are used by artists to enhance emotional responses between different modalities, for instance a musical soundtrack to a horror film. Furthermore, particular emotion responses are expected in many social situations: e.g., at a wedding this might mean happiness or perhaps sadness, but not boredom or disgust. These expected responses serve among other things to characterise the individual's relationship with the goals of the social group. Similarly, art or music will be present at many weddings, for instance, and is often socially required to express particular emotions, in the same way as the guests are. These examples point to the possible role of art in heightening and modifying emotions for social contexts.

At this point it is also worth pointing out the difference between emotions and moods, which sometimes causes confusion. Emotions are characterised by a short timespan, high intensity, and consequentiality; an emotion usually happens because something has occurred, or causes the person to do something. By contrast a mood is often a longer experience, of minutes or hours in duration, of less intensity, and does not usually directly cause something specific to occur.

Regardless of the vast number of works that continue to be generated after Izard's work, it seems apparent that emotion is a multi-part concept consisting of components that cover both subjective and objective responses. The notion of "componential theories of emotion" is thus increasingly prevalent in a lot of modern emotion studies. The next section (Sect. 10.4) hence discusses Scherer's component process model in detail, and describes some common approaches to evaluate its various components.

10.3 Evaluating Emotions

From the discussion in previous sections, it can be seen that detecting and analysing emotions is certainly non-trivial. One major problem is the enormous number of emotion theories to choose from before anyone embarks on evaluating anything. As mentioned previously, most state of the art emotion theories seem to revolve around concepts from Scherer's component process model, and its comprehensiveness means that many objective and subjective aspects of emotion are covered. The component process model also appears to have been shown to explain most emotional phenomena, with Scherer's (1984) paper cited over a 1,000 times.

The component process model describes an emotion as:

> an episode of interrelated, synchronized changes in the states of all or most of the five organismic subsystems in response to the evaluation of an external or internal stimulus event as relevant to major concerns of the organism (Scherer 1987).

These five organismic subsystems are namely:

Monitor, which keeps track of internal state and organism-environment interaction
Information processing, which serves to evaluate objects and events
Support, which regulates the system
Executive, which serves to prepare and direct action
Action, which communicates reaction and behavioural intention

The term **component** in the component process model refers to a component in an emotion episode, and represents the respective states of the subsystems listed above, namely (1) Subjective Feelings; (2) Cognitive Appraisal; (3) Physiological Arousal; (4) Motor Expressions; and (5) Behavioural Tendencies.

The term **process** refers to the coordinated changes of these components over time. The following subsections will discuss how each component can be measured and analysed.

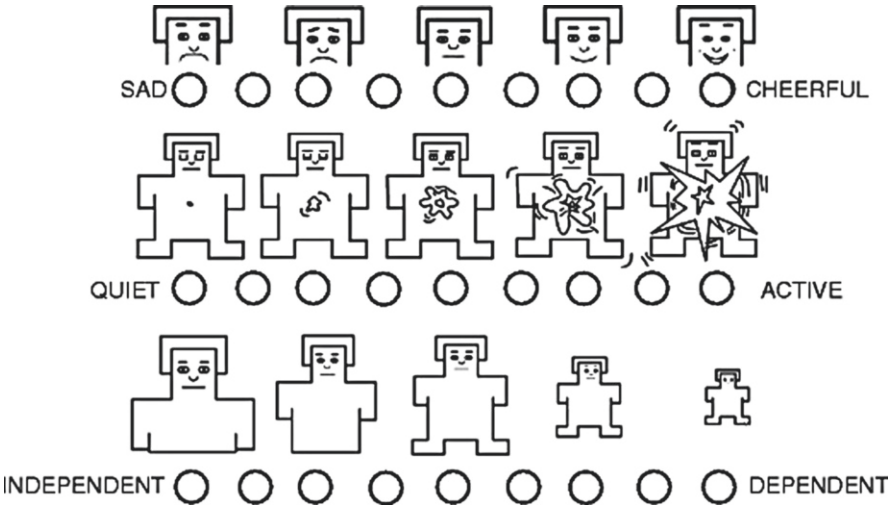

Fig. 10.1 The Self-Assessment Manikin (*SAM*) scale (Lang 1980) (Seen here in an adapted version from Schifferstein et al. (2011). With kind permission from Springer Science + Business Media: Schifferstein et al. (2011), Figure 2, p. 58)

10.3.1 Subjective Feelings

As the name implies, this component is subjective, hence self-reporting approaches dominate the exploration of this component. Extracting emotion data from think-aloud sessions (Lewis 1982) and structured or unstructured interviews is sometimes used but employment of more structured aids like the Self-Assessment-Manikin (SAM) scale (Lang 1980) or the Affect Grid (Russell et al. 1989) have been shown to be useful in getting richer and more consistent emotion data from experiments.

The SAM scale (as shown in Fig. 10.1) consists of three rows of manikins (i.e. abstract representative drawings of facial expressions) each with five manikins from low to high intensity. Each row of manikins represents an emotion dimension, namely valence, activation (or arousal) and control (or dominance). Participants are required to choose an intensity level from each of the three rows.

The affect grid (Russell et al. 1989) is a single-scaled questionnaire with a 9 by 9 matrix with eight adjectives (*Stress*, *Unpleasant Feelings*, *Depression*, *Sleepiness*, *Relaxation*, *Pleasant Feelings*, *Excitement* and *High Arousal*) around it describing the different emotions. The adjectives are similarly arranged by valence and activation. Participants are simply required to choose a single member in the matrix. Both the SAM and affect grid scales are non-verbal and hence reduce the cultural effects of verbalizing emotions.

10.3.2 Cognitive Appraisal

The cognitive appraisal component of the component process model aims to account for the fact that an exact same situation can induce different emotions in different people based on how a person interprets the situation. Scherer states that cognitive appraisals have five dimensions, namely intrinsic pleasantness, novelty, goal conduciveness, coping potential and norm/self compatibility. Intrinsic pleasantness captures how likely a stimulus event would trigger a positive or negative emotion. Novelty relates to how familiar the participant is with the particular stimulus. Goal conduciveness expresses how favourable the stimulus is with regards to the participant's goals and needs at that moment. Coping potential describes how much control the participant has over the stimulus. Norm/self compatibility establishes how close the stimulus matches the participant's standards.

To measure cognitive appraisal, the think-aloud method (Lewis 1982) is again commonly used whereby the appraisal dimensions can be extracted by performing a thorough qualitative analysis. Video-cued recall, in which the participant verbalizes their thoughts whilst viewing a recorded video of themselves in the activity, can also be used to reduce the intrusiveness of verbalizing during the activity (Bentley et al. 2003; Costello et al. 2005). For a more structured quantitative method, the Geneva Appraisal Questionnaire[1] can be used, which has been developed by Scherer based on the five dimensions previously mentioned.

10.3.3 Physiological Arousal

Physiological signals commonly include electrodermal activity (EDA), electrocardiogram (ECG), and pupillometry. EDA, also known as skin conductance level (SCL), measures the amount of sweat produced and is widely known to produce reliable measures for arousal. EDA is widely used due to its ease of use and minimal intrusiveness to the activity. ECG measures the heart rate and is similarly reliable for predicting arousal, as well as mental workload. There are some studies in using ECG to predict valence, but is generally still unreliable for this purpose. EDA and ECG are generally obtained via attachment of electrode sensors on the respective skin regions known to exhibit each signal with the highest magnitude.

Pupillometry measures pupil dilations (in the eye) is very similar to ECG with strong correlations between the size of the pupil and arousal as well as mental workload. However, reliably detecting pupil dilations without the effects of lighting is a huge challenge in natural environments. This is true for other physiological sensors as well, as EDA and ECG are very sensitive to movement at the physical sensing locations. These sensors are usually only viable in controlled laboratory settings.

[1] http://www.affective-sciences.org/system/files/webpage/GAQ_English.pdf

10.3.4 Motor Expressions

The motor expression component is related to physiological responses but appertain to muscle activity. It primarily involves facial expressions, gestures and speech. For facial expressions, Ekman might hold the throne for devising some of the most influential systems for analysing expressions. The Facial Action Coding System (FACS) (Ekman et al. 2002) is a widely used basis for both human coding and automatic facial expression detection in video. FACS labels 46 action units (AUs) that can be combined to represent almost any human facial expression. However, usage of FACS needs intensive training for human coders, and automated systems are still far from robust enough to detect even half of the AUs (Baltrusaitis et al. 2011; McDuff et al. 2011).

The alternative to FACS coding is electromyography (EMG), which measures spontaneous muscle activity. Capturing the major zygomaticus (near the cheek) and corrugator supercilii (near the eyebrow) muscles have been well known to reliably denote valence. The hardware to measure EMG is very similar to the electrode-based sensors used for EDA and ECG: hence it suffers from the same deployment restrictions and drawbacks, but otherwise allows for a very precise and reliable capture of facial expressions.

Although less studied, characteristics of speech have been shown to correlate well with emotions as well (Banse and Scherer 1996). Speed, intensity, melody and loudness are all possible dimensions of speech that can be used to infer emotions.

10.3.5 Behavioural Tendencies

The behavioural tendencies component captures the readiness of a person to react in a certain way to a certain stimulus. Measuring behavioural tendencies often mean trying to benchmark a person's habitual performance. Common methods include recording the task times and counting number of successes/errors, as well as questionnaires that query intentions of use. Nevertheless these approaches have reliability problems (Sears and Jacko 2008).

In terms of objective approaches, Partala and Surakka (2004) have shown that EMG can also be used to infer behavioural data. They showed that higher success rates and goal conduciveness were related to low activation of the corrugator supercilii muscle.

Although this section is primarily concerned with Scherer's component process model, it should be noted that this should not imply a call for more emotion studies to be based only on this model. Instead, what this section aims to do is to use the categories provided by the component process model as representatives of what the various common important components required of evaluating emotions. The component process model is undoubtedly highly influential, but fundamentally it simply represents an attempt to capture emotion processes as comprehensively as possible. As can be seen there are many emotion aspects that can be investigated, and may be

useful depending on the criteria being evaluated – each of these components can be the basis for developing an emotion criterion that may perhaps uncover some aspect of an artwork.

10.4 Evaluating Emotions in Interactive Art

In interactive art forms, evaluating emotion becomes even more challenging, primarily due to the fact that data collection and analysis becomes harder as user responses are disrupted by the apparatus necessary for physiological measurement. Hence there is a need for investigations on new methods of evaluating emotions in interactive art.

Research in this area is sparse, and many of the studies involve evaluation of video games. Video games represent a type of art that falls into a large number of genres that cater to the tastes of the general public, with a profile broadly mirroring that of cinema, but with the added element of a high degree of interactivity. Much of the new interactive sensor and display technology is often based in research undertaken by game console manufacturers (e.g. The Kinect sensor). They are highly time-critical interactive art forms, with a great deal happening at every moment in time for a player. Game designers carefully craft each and every encounter in the game so as to create a high level of immersion, engagement and ultimately flow experience (Csikszentmihalyi 1990) for the player. It is notable that engagement, a factor commonly discussed for evaluating interactive art, is also extremely important in gaming, with most game designs aiming to engage a player over periods of 20–30 h and upwards. Playtesting – the evaluation of game designs with users while they are under development – is a crucial stage in the fine-tuning of games before they are released for sale.

In the context of this book, the evaluation of interactive musical systems in a museum space in Chap. 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings"), by Bengler and Bryan-Kinns (2014) is not dissimilar to evaluation using a playtesting system for interactive gaming. The obvious difference in their case is that the final audience was present and evaluation was carried out within the presentation of the work, instead of being part of a pre-release session. Evaluation in their case included a questionnaire regarding the feelings that the interactive instrument engendered in the audience, in response to some probe statements about the interface.

Several studies have attempted to push the state-of-the-art in collecting, analysing, and using emotional data in evaluating games, and these will be detailed below.

10.4.1 Emotion Evaluation Research

Evaluation based on emotional qualities has wide research interest within the field of interactive games. Yannakakis and Togelius (2011) created a large computational framework to evaluate player experiences in order to procedurally generate content

in games. In their affect sensing system, they combined subjective self-reports, objective physiological responses, and gameplay metrics to create a hybrid model of player experience. This model is then used to automatically generate content in the game, tailored to each player. They have implemented and evaluated this framework in various example games and showed that the framework was highly feasible. However, the challenge lies in the complexity of choosing appropriate combinations of self-reporting methods, physiological signals and gameplay metrics when a different activity needs to be evaluated. Nevertheless, an important conclusion is that a hybrid of these three metrics is highly effective in capturing emotional states. In a way, this method also reinforces the conceptual basis underlying the component process model.

Hazlett (2006), on the other hand, focused solely on investigating whether facial EMG was a good measure of emotional valence in gameplay. He collected facial EMG responses for 13 boys playing a car racing game and compared them with a video review. He found that the zygomaticus muscle, which controls smiling, was significantly greater during positive events, and that the corrugator muscle, which controls frowning, was significantly greater during negative events. Another conclusion was also that EMG is still reliable during high intensity interactions with a high mental load. This showed that facial EMG is highly feasible for detecting emotional valence, and in turn that this dimension of emotion can be captured for analysis without reliance on self-report techniques.

Canossa et al. (2010) devised a system for detecting frustration whilst playing games. Frustration is a derived emotion, which is commonly associated with high arousal and negative valence, and the delicate balance of frustration can make or break the flow of gameplay in many modern video games making it a crucial parameter to evaluate. In their work, they combined direct player observations and data mining of gameplay metrics within a computational model in order to detect frustration. They have shown that this method is successful in the specific third-person shooter game they have employed it on, but make no claims outside of that game. They also cautioned that the intervention of a human expert is generally necessary in order to properly evaluate their automatically captured data.

In the domain of educational games, Conati (2002) attempted to detect emotional states of players in a Mathematics game they have developed. Their emotional states are primarily based on the OCC cognitive theory of emotion (Ortony et al. 1990) that consists of 22 emotions classified according to valence and situational appraisals, in which they chose six emotions for their study. In their work, they created a complex affective model using a dynamic decision network that incorporates personality, goals, bodily expressions and physiological data in order to obtain probabilities for the emotional states. They then used these values in a pedagogical agent that attempts to dynamically affect gameplay based on the emotions gathered. The major shortcoming of this work is that there are no formal evaluations performed.

In non-game related work, research did not seem to study emotion primarily as an evaluation tool. Instead, researchers/artists explored the use of affective interfaces to elicit emotional responses as part of the interactive artworks themselves (Vogt et al. 2009; Gonsalves et al. 2009; Iacobini et al. 2010). For example, (Gonsalves et al. 2009; Iacobini et al. 2010) investigated the use of automatic facial expression recognition to evaluate emotions. They created an art installation called

Chameleon that involves the use of emotional video portraits that responded according to the emotions detected by the expression system. The emotions are classified based on Ekman's six basic emotions (Ekman et al. 1992). They analysed interviews with participants who experienced the interaction and results showed that the system managed to create a variety of emotional experiences, ranging from empathy to intimacy. Bialoskorski et al. (2009) created an interactive art system called 'Mood Swings' that attempted to use the emotional state of the audience as an input to the changing parameters of the colours presented by the artwork, which in turn are expected to influence the emotional state of the audience. They used the physical movements of the audience as a proxy for their emotional state, associating valence and arousal to the physical smoothness and velocity of movements, respectively.

Vogt et al. (2009) studied the use of the state of the audience's spoken voice as a cue to the emotional state of the audience, in a series of interactive artworks discussed. Emotional data is extracted by analysing acoustic features such as pitch, energy, pauses, spectral and cepstral information, and then using this data in real-time classifier systems.

Finally, Höök, Sengers and Anderson (2003) investigated and evaluated the effectiveness of an affective interface, 'The Influencing Machine', through a set of interviews of various groups of users of the machine. Their participants reported that they had been 'influenced' by it, and therefore that it was capable of eliciting emotions.

10.4.2 Automated Facial Expressions Analysis in Games

In the first author's own work (Tan et al. 2012), an attempt to use facial expression recognition for evaluating user experiences of games is presented. This work focuses on the motor expressions component of the component process model, as it is relatively less studied. However, their aim was to find out whether automatically captured facial expressions from video can be used effectively for inferring video gaming experiences. The motivation behind this method, other than it being under-evaluated, is that facial expressions are timely, continuous and minimally disruptive. Compared to other objective approaches like physiological measures, facial expression analysis allows for more authentic play experiences and enables data collection in non-laboratory settings. Motion detection game consoles like Microsoft's Kinect[2] and Nintendo's3DS[3] implicitly incorporate video feeds into gameplay, but for other games, webcams are also relatively prevalent in most computing devices nowadays. This means that this type of analysis does not require significant intervention in terms of apparatus or experimental design.

A pilot study was conducted with users interacting with two video games, namely Portal 2 by Valve[4] and Draw My Thing by OMGPOP.[5] Twelve participants played

[2] http://www.xbox.com/en-US/kinect/

[3] http://www.nintendo.com/3ds

[4] http://www.thinkwithportals.com

[5] http://www.omgpop.com/games/drawmything

Fig. 10.2 Screenshot of the Facial Expression Recognizer when a participant played Portal 2. The *white curved lines* on the face automatically track the facial expressions of the participant and the expression intensities are shown on the *top-left*. The actual game screen is also shown in the *top-left* sub-screen

the two games one after the other in a room by themselves, with a webcam capturing their facial expressions.

Figure 10.2 shows the screen capture of our system analysing a participant in real-time. For this pilot study, three common expressions out of the six basic emotions (Ekman et al. 1992) were automatically classified, namely joy, surprise, and anger, with an additional neutral expression as the baseline. After playing, participants filled in the Game Experience Questionnaire (Nacke 2009) and were briefly interviewed at the end of the session.

In our findings, strong correlations were found when comparing the automatically captured expressions with the self-reported experiences, as well as with a visual inspection of the videos. Another interesting observation was the difference in the expression variances between the two games being played, with Portal 2 showing a higher variance. This implies that the automatically recorded expressions might have captured the different qualities between different game genres.

When performing a visual inspection of the videos, an obvious physical limitation of the system was also found: a number of participants placed their hands on their faces during play. A participant also had a lot of empty readings when a significant portion of his/her face went out of view. Fortunately, these occurrences were rare in this study.

Overall, participants felt that the presence of the facial expression detection system was generally not obtrusive to their experiences. At the end of each session, the participants were asked about whether aspects of the experimental setup affected their play. Responses were generally positive although some did express a small amount of discomfort. For example, one participant said “Forgot all about the video recording!!!” whilst another said “Not really - only when I switched between games, or was waiting for a game.” This shows that the video-based approach was largely unobtrusive to the interactive gaming experiences of the participants.

Apart from video games, other forms of interactive artworks also generally require participants to be actively involved in doing something. This mental load takes the attention away from the recording device and so the presence of the device would not be as intrusive as participants simply viewing a traditional art gallery for example.

10.4.3 Discussion

As can be seen, the topic of evaluating interactive experiences in terms of emotion is not yet well-established one. There are no "standard" procedures to follow nor evaluation "best practices". Researchers are still struggling to figure out what works best in different types of interactive art. On the flip side, it also means that this is an exciting area that many potential discoveries can be made. However, as researchers elucidate and develop more of an understanding of the ways in which emotional responses function, and as more and more technical methods for obtaining data about emotion become commonplace, more opportunities for meaningful evaluation of interactive digital art are presented.

This is a more difficult problem than that of a typical HCI research process, where particular computer interaction goals can be articulated in terms of completion or performance, and various methods and measures can be devised to assess the degree to which the goal is met. The challenge for research is to articulate the connection between the evaluation objective and the emotion evaluation technique employed. Emotion data can be obtained in such a myriad of ways that understanding the context for the evaluation is crucial to the choice of method. As seen above, methods range from highly intrusive, physiological methods, to methods that intrude only insofar as a camera intrudes, to self-report methods are only undertaken after the artefact has been experienced.

The further challenge is the employment of the data that is created from any evaluation. The emotion model presented here, Scherer's component process model, actually incorporates a number of theories of emotion into one larger integrative system. The challenge for practitioners is how to operationalise this knowledge in an evaluation context. The example from Tan's work given here, facial expression recognition, shows that information about emotion can be automatically captured during playtesting, and that they correlate well with the self-reported experience. If an emotion goal for the evaluation of an artefact can be articulated, such a system can be used to evaluate the level to which that goal is achieved.

10.5 Conclusions

This chapter has discussed the role of emotion in the experience of art. It has introduced some theories of emotion including Scherer's componential approach, and has discussed defining characteristics of emotion research. It has also demonstrated some important ways of characterising emotion using different measurement or

response methods. Finally, it discussed several state-of-the-art works in evaluating emotions for interactive art.

In general, it can be seen that evaluating emotions is highly complex and involved, requiring the conceptual integration of a variety of different approaches and factors. Each activity, whether it is viewing art in an art gallery, listening to an orchestra, or playing a video game, involves a major investment in terms of evaluating which methods are appropriate for the task at hand. The resulting method is usually a mix of both qualitative and quantitative methods, involving both subjective and objective measures. Though complex, including emotions in the evaluation of experiences of art is a valuable task that can greatly enhance the understanding of these experiences.

References

Baltrusaitis T, McDuff D, Banda N, Mahmoud M, Kaliouby RE, Robinson P, Picard R (2011) Real-time inference of mental states from facial expressions and upper body gestures. Face Gesture 2011:909–914. doi:10.1109/FG.2011.5771372

Banse R, Scherer KR (1996) Acoustic profiles in vocal emotion expression. J Pers Soc Psychol 70(3):614–636. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8851745

Bengler B, Bryan-Kinns N (2014) In the wild: evaluating collaborative interactive musical experiences in public settings. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 169–186

Bentley T, Johnston L, von Baggo K (2003) Affect: physiological responses during computer use. Proc OZCHI 2003:174–182

Bialoskorski LSS, Westerink JHDM, van den Broek EL (2009) Mood Swings: an affective interactive art system. In: Proceedings of intelligent technologies for interactive entertainment, vol 9. Springer LNCS, pp 181–186

Cannon WB (1927) The James-Lange theory of emotions: a critical examination and an alternative theory. Am J Psychol 39(1):106–124. doi:10.2307/1415404

Canossa A, Drachen A, Rau Møller Sørensen J (2010) Arrrgghh!!!-blending quantitative and qualitative methods to detect player frustration. In: Proceedings of the 2011 Foundations of digital games conference. ACM, Bordeaux. Retrieved from http://www.mendeley.com/research/arrrgghh-blending-quantitative-qualitative-methods-detect-player-frustration-1/

Conati C (2002) Probabilistic assessment of user's emotions in educational games. Appl Artif Intell 1–20. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/08839510290030390

Costello B, Muller L, Amitani S, Edmonds E (2005) Understanding the experience of interactive art: iamascope in beta_space. In: Proceedings of the second Australasian conference on interactive entertainment (IE '05). Creativity & Cognition Studios Press, Sydney, pp 49–56

Csikszentmihalyi M (1990) Flow: the psychology of optimal experience (Book). Lib J 115(5): 105

Egermann H, Sutherland ME, Grewe O, Nagel F, Kopiez R, Altenmuller E (2011) Does music listening in a social context alter experience? A physiological and psychological perspective on emotion. Music Sci 15(3):307–323. doi:10.1177/1029864911399497

Ekman P, Francisco S, Lazarus R, Levenson R, Oster H, Rosenberg E (1992) An argument for basic emotions, vol 6. Lawrence Erlbaum Associates Limited

Ekman P, Friesen WV, Hager JC (2002) Facial action coding system. FACS, vol. 48. A Human Face. pp 4–5. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Faial+Action+Coding+System+Investigator's+Guide#0

Evans P, Schubert E (2008) Relationships between expressed and felt emotions in music. Music Sci 12(1):75–99. Retrieved from https://jyx.jyu.fi/dspace/handle/123456789/19438

Gonsalves T, Frith C, Averbeck B, Kashef Y, Mahmoud AN, Kaliouby RE, … Sloan H (2009) The chameleon project: an art installation exploring emotional contagion, 2009. In: 3rd international conference on affective computing and intelligent interaction and workshops, Amsterdam, The Netherlands, 1–2 (2009). IEEE. doi:10.1109/ACII.2009.5349522

Hazlett R (2006) Measuring emotional valence during interactive experiences: boys at video game play. In: Proceedings of CHI, Montréal, Québec, Canada, pp 1023–1026. Retrieved from http://dl.acm.org/citation.cfm?id=1124772.1124925

Höök K, Sengers P, Andersson G (2003) Sense and sensibility: evaluation and interactive art. CHI Lett 5(1):241–249

Iacobini M, Gonsalves T, Bianchi-Berthouze N, Frith C (2010) Emotional contagion in interactive art. In: Proceedings of the international conference on Kansei engineering and emotion research, Paris, France

Izard CE (1977) Human emotions (Emotions, Personality, and Psychotherapy series). Plenum, p 495. Retrieved from http://www.amazon.com/Human-Emotions-Personality-Psychotherapy/dp/0306309866

Kleinginna PR, Kleinginna AM (1981) A categorized list of emotion definitions, with suggestions for a consensual definition. Motiv Emotion 5(4):345–379. doi:10.1007/BF00992553

Krumhansl CL (1997) An exploratory study of musical emotions and psychophysiology. Can J Exp Psychol 51(4):336–353. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9606949

Lang P (1980) Behavioral treatment and bio-behavioral assessment: computer applications. Technol Mental Health Care Deliv Syst 119–137. Retrieved from http://www.citeulike.org/user/acagamic/article/3756983

Lazarus RS (1991) Emotion and adaptation. In: Pervin LA (ed) Handbook of personality theory and research, vol. 21. Oxford University Press, pp 609–637. doi:10.2307/2075902

Lewis CH (1982) Using the "Thinking Aloud" method in cognitive interface design (Technical report RC-9265). IBM

McDuff D, Kaliouby R el, Kassam K, Picard R (2011) Acume: a new visualization tool for understanding facial expression and gesture data. In: Face and gesture 2011. IEEE, pp 591–596. doi:10.1109/FG.2011.5771464

Nacke LE (2009) Affective ludology: scientific measurement of user experience in interactive entertainment. Belkinge Institute of Technology, Karlskrona

Ortony A, Clore GL, Collins A (1990) The cognitive structure of emotions. Cambridge University Press, Cambridge, p 224. Retrieved from http://www.amazon.com/Cognitive-Structure-Emotions-Andrew-Ortony/dp/0521386640

Partala T, Surakka V (2004) The effects of affective interventions in human–computer interaction. Interacting with Computers 16(2):295–309. doi:10.1016/j.intcom.2003.12.001

Russell JA, Weiss A, Mendelsohn G (1989) Affect grid: a single-item scale of pleasure and arousal. J Pers Soc Psychol 57(3):493–502. doi:10.1037//0022-3514.57.3.493

Schachter S, Singer JE (1962) Cognitive, social, and physiological determinants of emotional state. Psychol Rev 69(5):379–399. doi:10.1037/h0046234

Scherer KR (1984) On the nature and function of emotion: a component process approach. In: Scherer KR, Ekman P (eds) Approaches to emotion. Erlbaum, Hillsdale, pp 293–317. Retrieved from http://www.affective-sciences.org/node/342

Scherer KR (1987) Toward a dynamic theory of emotion: the component process model of affective states. Geneva Studies in Emotion 1(1987):1–72

Schifferstein HNJ, Talke KSS, Oudshoorn D-J (2011) Can ambient scent enhance the nightlife experience? Chemosens Percep 4(1–2):55–64

Sears A, Jacko JA (2008) In: Sears A, Jacko JA (eds) The human–computer interaction handbook, Section C. Testing and evaluation, vol 29. Lawrence Erlbaum Associates, p 1386. Retrieved from http://courses.washington.edu/imt540a/readings/Blomberg-08.pdf

Tan CT, Rosser D, Bakkes S, Pisan Y (2012) A feasibility study in using facial expressions analysis to evaluate player experiences. In: Proceedings of the 8th Australasian conference on interactive entertainment: playing the system. ACM, New York, pp 5:1–5:10. doi:10.1145/2336727.2336732

Vogt T, Andre E, Wagner J, Gilroy S, Charles F, Cavazza M (2009) Affective interfaces and ambient artwork. In: Proceedings of the 3rd international conference on affective computing and intelligent interaction, Amsterdam, The Netherlands, pp 1–8

Yannakakis G, Togelius J (2011) Experience-driven procedural content generation. Affect Comput, IEEE, 1–16. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.59.8690&rep=rep1&type=pdf

Chapter 11
Blending Art Events and HCI Research

Derek Reilly, Fanny Chevalier, and Dustin Freeman

Abstract We present experiences as artists and Human-Computer Interaction (HCI) researchers exhibiting an interactive artwork called *Tweetris* at a public event, and its simultaneous research evaluation. We describe the unique opportunities a public art event offered for achieving our research goals, then discuss three key challenges we encountered: tensions between creative and research goals before the event, ethical considerations during the event and in analysis, and obstacles complicating subsequent evaluation as the work has evolved. We offer observations throughout that are important to consider when conducting HCI research at public art events.

11.1 Introduction

Public art events are attractive venues for HCI research, as we move away from the desktop toward more situated, embodied forms of interaction. As a relatively untested avenue for HCI research, the public art event presents unique opportunities for the evaluation of advances in interactive technology, but also comes with novel challenges. It is critical to report and reflect upon experiences as we experiment in this space, to build a common understanding of what works well and what does not for artists and researchers alike. This chapter presents our experiences with *Tweetris*, an interactive digital artwork employing whole-body interaction in a game-within-a-game format. In particular, we highlight strategies taken when designing an

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Fig. 11.1 Playing *Tweetris*. *Left three*: a pair of attendees plays the shape-matching game in a moving van. *Far right*: snapshots of the players making the shapes are used in Tetris gameplay which was broadcast onto the street outside the gallery to attract the interest of the art event attendees passing by

empirical study around a rapidly evolving creative art project, ethical ambiguities that arose when taking on the dual roles of artist and HCI researcher, and the challenges encountered when taking the artwork and the research forward into other venues (Fig. 11.1).

11.1.1 Tweetris *at Nuit Blanche*

We developed *Tweetris* as an interactive art project for the 2011 Nuit Blanche event in Toronto. At the core of *Tweetris* is a shape-matching game, where two players race to match the shape of their body to a *tetromino*, a shape composed out of four squares taken from the game Tetris. The gameplay is similar to the segment called *Brain Wall* on the Japanese television show *Tonneruzu no Minasan no Okage deshita*. When the shape of a requested tetromino is successfully formed and held by a player, a video snapshot of the winning shape is tweeted on a public Twitter account, with a semi-random but descriptive shape-related caption. The tetromino snapshots are also used in a game of Tetris that attendees can play using their portable devices.

The shape matching game was set up at two locations in downtown Toronto: at OCAD University's graduate student gallery, and in a moving van on Queen Street West. In both locations, shape-matching players were watched and encouraged by an audience of fellow Nuit Blanche attendees. Shape matching and Tetris gameplay was also broadcast onto the street outside the gallery to attract the interest of the art event attendees passing by. By making the activity of the shape makers public across multiple channels, our intention was to contrast the visceral experience of embodied play with more meditative questions about what it means to engage in a public game.

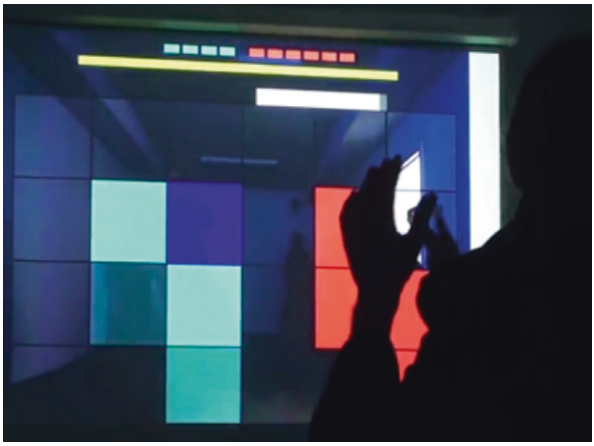

Fig. 11.2 Close-up of player feedback. Players try to cover *all coloured squares* with their bodies without going outside the squares. They must hold their pose for 2 s while the white progress bar (*top*) completes to score a point, incrementing the tally shown by the *red* and *blue squares* at the *top* of the screen. A *yellow progress bar* counts down a 10 s maximum time to make a shape, after which a new shape appears

Tweetris was initiated by artists whose interest lay in the creative process and in the outcome of a collaborative interactive art project, and an HCI researcher who believed the project could also be used to study interaction. The main reason for the work was to collaborate on an art project that would give visibility to a new faculty group at OCADU, an art and design university in Toronto, Canada. Exhibiting a piece at Nuit Blanche was an ideal opportunity to this end. As the project progressed and more collaborators came on board, plans for conducting a study alongside the exhibit fell into place, but the creative practice and its relevance for artists and their audience remained the primary concern. Indeed, the HCI researchers were deeply engaged in creating and exhibiting *Tweetris*. Our emphasis differs from Johnston's Chap. 4 ("Keeping Research in Tune with Practice", Johnston (2014), in that, rather than being targeted to practicing performers, this chapter aims to inform HCI researchers about the unique benefits and challenges associated with conducting evaluations at a public art event.

11.1.2 Playing Tweetris*: The Shape-Matching Game*

The experience of *Tweetris* from the shape-matcher's perspective is shown in Fig. 11.2. Two players walk into the game area, and the interface presents a video view of the two players in real-time. The video is overlaid with a grid, six wide and four high in which squares will turn a translucent colour to communicate to the player. A light colour, either red (right) or blue (left) indicates that the player should occupy that square to match the shape. Shapes are selected randomly from the set of blocks from the game Tetris (tetrominos).

When a player correctly occupies a grid square, the colour changes. If a player occupies a square that is not part of the goal shape, that square turns purple. Players must contort their bodies in the play area until their body fits inside and fills the

tetromino, before the other player does. When a player occupies all four of the required grid squares for the given shape (and only those four), they must hold their pose for 2 s, while a white progress bar goes across the screen on top. If neither of the players is able to make the goal shape before a 10 s countdown—shown by the decreasing length of the yellow bar at the top of the screen, then a new random shape is selected and displayed. Each player has a counter indicating the number of tetrominos they have made successfully—shown as red and blue blocks at the top of the screen. When one player successfully makes ten shapes, the counters are reset.

11.1.3 A Flexible Play Style

To facilitate fluid engagement and disengagement by visitors to the exhibit, the game does not rigidly enforce play mechanics. There are no written or verbal prompts structuring gameplay. Players are free to enter and leave the exhibit at any time; the game makes no distinction between individual players as they enter or leave; the game will happily run in the background when nobody is playing, and the counters can easily be ignored during casual play. Two players can play simultaneously, but people can also play by themselves, by choosing one of the two sides.

The left player is always blue, and the right player always red. If players switch sides during play, they will switch blue/red assignments. It is also possible for more than one person to work together to form a tetromino, so long as they are on the same side of the play area and stay within the shape squares.

We chose to keep the play mechanics constraints in *Tweetris* as flexible as possible for two reasons. First, by letting visitors drop in and drop out the game at will, we could provide an interactive, engaging and creative art installation where attendees would feel encouraged to actively participate while avoiding frustrations that might occur by set play duration. Second, we wanted to make it possible for the players to collaborate with one another to form a single shape. Whole-body interaction is traditionally designed and evaluated for a single user, and we were curious as artists and researchers to see whether a player would enter the physical space of the other player, either to help them when they have to perform a challenging shape (e.g., one that requires balance), or to "sabotage" their play, by occupying extra blocks with their own body.

During the event, we saw a wide range of creative play, including some acrobatics, sabotage, focused competition, and lots of laughter. Attendees usually played in pairs, playing between 30 s and 10 min, but averaging 3 min (the average duration of one full round of the shape matching game).

11.2 The Opportunities for HCI Research

The desire to conduct HCI research or at least to generate HCI-relevant outcomes was one motivation in the design of *Tweetris* from the outset. We were broadly interested in exploring how whole-body interaction and video-mediated communication over large displays could be used in collaborative play. In this section we consider potential benefits of conducting HCI research of different kinds at public art events.

11.2.1 Perceived Benefits of the Public Art Event

We identified two main benefits that made conducting HCI research using the *Tweetris* exhibit attractive to us. First, as an exhibit in *Nuit Blanche*, which sees over one million attendees in a single night, we had an opportunity to acquire data from a sample that was literally orders of magnitude larger than what we were used to in controlled studies (and to do this over a very short time-span). The challenge was to determine the type of study we could reasonably run given the very dynamic and unpredictable flow of the event. We had to carefully consider how to weave a study into the exhibit in such a way that it did not detract from the attendees' experience.

The second benefit became apparent only as the *Tweetris* concept had been solidified and the interactive elements were being fleshed out. Those on the team interested in HCI research came to view the exhibit as a semi-controlled environment conducive to analysis of relatively focused aspects of whole-body interaction. We also believed that since people might feel compelled to engage with *Tweetris*, they might be more willing to explore and experiment with interaction, in contrast with a controlled study of interaction techniques with tasks designed to assess performance characteristics such as time and error rates, where often participants simply desire to complete the tasks. In fact, we came to view *Tweetris* shape-making as a form of controlled, randomized repeated stimulus that was also inherently fun, engaging a general audience in a public setting away from the research lab—offering some of the benefits of both situated studies of playful engagement and controlled studies of interaction techniques.

11.2.2 Curiosity-Driven and Hypothesis-Driven Research

Our experience with *Tweetris* illustrates that the answer to where and when opportunities for HCI research emerge from art depends on the artistic process as much as on the interests of those involved. While Chap. 2 ("Human Computer Interaction, Experience and Art", Edmonds (2014), establishes that both HCI research and interactive art are concerned with experience and engagement, the ways in which these are assessed in a given type of HCI research might not align with the way they are

generated in a specific interactive artwork. Determining specific research questions and methods was possible only later in our project's development.

The broader opportunities that *Tweetris* presented for HCI research may apply to a wide range of interactive artworks. Curiosity-driven explorations of novel interactive works can occur even in the absence of specific research hypotheses. Such research is often quite robust to (and even focussed upon) the unexpected elements of public art events and exhibits. Chapter 12 ("In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings") by Bengler and Bryan-Kinns (2014), illustrates how a mix of quantitative and qualitative observational methods can illuminate engagement with novel interactive experiences, allowing reflection on the success of design motivations and uncovering questions for further research. Given the right combination of elements there is also room for highly focused, hypothesis-driven research at public art exhibits. As we see with *Tweetris*, interactive exhibits can provide a structured experience that allows in-depth analyses of specific aspects of interaction. Such research often requires a well-defined experience from which to design the study, however, something that is not always amenable to the artistic process, as we discuss in the next Section.

11.3 Reconciling Artistic Aims and Research Goals

Because *Tweetris* was being developed for a specific event, we worked under a deadline. This meant that as the event approached, most effort went into making sure the exhibit would be successful and concerns that the research would be conducted as intended were secondary.

We made a decision early on that the needs of the research should not explicitly influence or constrain our creative process. *Tweetris* is a creative piece first, and one that involved the engagement of a range of contributors throughout its lifecycle. As mentioned, the HCI researchers were also major contributors to the artwork, rather than taking on an observational role; this made it possible for us to adjust our research goals in fairly subtle ways to match the evolution of *Tweetris*, and to be supportive when larger changes needed to be made. We already needed to manage tensions between artistic vision and technical constraints, and adding further constraints due to research concerns may have made such a collaborative project untenable. Our approach was to align our research questions with a major theme of the creative work, specifically the collaborative vs. competitive modes of whole-body interactive play.

11.3.1 Aligning Research Goals with Creative Themes

From a very early stage, our concepts for the artwork involved trying to form body shapes with the help or hindrance of others, given some form of suggestive cue

(for example, floating wishbones would suggest that a "Y" shape be made). Initially, these cues would themselves be controlled by an unseen third party as a *deus ex machina*, who would attempt to establish contact with the collaborative/competitive players through the limited language of shape cues.

In these earlier concepts, some of the shapes presented to players would only be possible to accomplish collaboratively, while others could be done independently. In our desire to make a compelling interactive experience, we felt that it would be interesting to leave it up to attendees to figure this out; to offer incentive for both independent/competitive and cooperative play, and see what transpires. Tying a reward system to shape-making would introduce a tension between collaborative and cooperative modes of play, and we believed this could form the focal point of our research. We were interested therefore in observing how our participants would manage this tension, and designed questions in a *post-hoc* questionnaire to tease out reasons for their behaviour. We also constructed questions that probed whether participants sensed the presence of the unseen third participant, and if so, whether they were viewed as collaborator or foil.

As our concept evolved toward the Tetris theme, our *deux ex machina* ideas evolved into the game-within-a-game aspect of the work. This occurred in two ways. The first was through an explicit attempt to playfully anthropomorphise the game. *Tweetris* would maintain communication across its different components through a Twitter feed, tweeting images of shapes and of players making shapes. The second was to embed some communication between those playing the Tetris game and those playing the shape-matching game: i.e. those playing the Tetris game could request shapes, and the shape-making pair could choose to make the shape or avoid making it, adding an additional "collaborate or sabotage" element to the piece. We revised questions in the questionnaire to assess how shape-matching players managed their relationship with this new type of third player.

Aligning research questions and creative themes in this way made pragmatic sense, as we had good confidence that the research questions could be accommodated within the theme. It would also allow us to explore the research themes from aesthetic and experiential perspectives as well as more rational and scientific ones.

11.3.2 A New Turn: Studying Whole-Body Interaction

Additional research questions on interaction emerged by distilling *Tweetris* down to its basic elements by viewing shape-matching as a relatively unconstrained, *metaphor-free* stimulus for whole-body interaction. That is, the specific shapes themselves didn't hold symbolic or direct meaning (Holland et al. 2011), which could otherwise influence the way players respond to the shapes, and the shapes didn't dictate exactly how they should be made using the body. As such, we became interested in evaluating *Tweetris* as a platform for observing the influence of environmental factors (audience, location) and intrinsic factors (physiology) on whole-body interaction. Since we do not strictly control how shapes are made, we allow

playfulness to emerge and permit an experience of "flow" (Csikszentmihalyi 1990; Nijholt et al. 2011).

By viewing *Tweetris* in these more abstract terms, research questions emerged that did not impose upon the creative work, and that were relatively impervious to deviations leading to the final work, so long as the Tetris shape-making component remained intact. Specifically, how would the game's physical setting impact shape formations, and what kind of shape making patterns would we see across individuals? While these "emergent" research questions were forming during the development process, we were still largely focused on questions regarding collaboration vs. competition in our study design.

11.3.3 Reconciling Research and Creative Process: Challenges

Despite the efforts to align research goals with creative themes, when the final work was created, our primary research questions (exploring how and why players choose to collaborate or compete) were no longer possible to evaluate. We started testing the game with standard Tetris blocks, which could all be completed by a single individual. We considered two approaches to introducing a collaborative aspect to shape making. The first was to introduce more complex shapes that required two people to complete, and the second was to have players play in different locations, using a shared video space to fit into the same shape. In the course of tight development cycles we decided that the collaborative/competitive ambiguity might not be conducive to the walk-up-and-engage game experience that our venue required. Instead, the competitive mode of the game was favoured for its immediacy. Due to issues sending video data we redesigned the game so that two players compete in the same location, with tetrominos side-by-side. Even though we did not prevent players from making the same shape together, the two-player competitive mode was reinforced by the final design, which featured two score bars and two distinct play areas. For similar reasons (technical issues, timeframe and a desire to streamline the experience), we removed the ability of the Tetris game players to request shapes from the shape makers.

These changes prevented an exploration of collaborative vs. competitive modes of play, yet allowed us to focus more directly on the secondary research questions: namely, what body configuration strategies emerge in a relatively unconstrained shape-matching task, and how play environment impacts this. Without the nuances of shape requests and collaborative vs. competitive shape making, we could focus our analysis on how individuals made shapes. This realization came very close to the event though. At the time of the event, our instruments were still predominantly geared toward observing and eliciting feedback on group behaviours. A significant portion of our questionnaire asked about competition, cooperation, and awareness of those playing Tetris. After administering the questionnaire to the first 60 participants at Nuit Blanche we decided it was not worthwhile and left out the questionnaire for the rest of the event. This was because many of the questions dealt with the collaboration vs. competition theme, which was no longer

present in the final version of *Tweetris.* Our software logging captured game state and game events (emphasizing social engagement) rather than skeleton position (emphasizing whole-body interaction techniques). This meant that our analysis of interaction style required a time consuming post-experimental manual encoding of postural configurations for each successful shape made, which was possible only because we had a Twitter snapshot of every successful shape. Again, our focus on game events meant we did not capture "misses" or unsuccessful poses as distinct events (these were simply ignored by the game). Reconstituting these for analysis would require careful calibration of sensor and video data, manual identification of pose sequences along the timeline, and the use of grainy and dark video capture to determine postural configurations. As previously mentioned, the randomized, repeated task of shape making was well-suited to conducting this type of analysis. The flexible play style of *Tweetris*, allowing play without fixed duration and strict rules, placed limitations on our analysis however, and we could not treat the data as though each attendee had the same quality and duration of experience. This limited our ability to identify common patterns in how *sequences* of shapes were made in particular, since attendees played for widely varying lengths of time.

11.3.4 Research Outcomes

This new focus on the secondary research questions allowed us to arrive at and formally propose a new *elicitation protocol* for whole-body interaction styles. During analysis we came to view the tetromino shapes as *discretized silhouettes*, blocks that one had to fill with their bodies, but not in a predetermined way. As such, *Tweetris* "elicited" whole-body poses and patterns of transitions between poses that could be useful for designers of other whole-body interactive experiences in a similar fashion as Wobbrock et al. elicit hand gestures with their User-Defined Gestures protocol (Wobbrock et al. 2009).

In addition to identifying specific impacts of environmental factors such as crowd location, physical layout and flooring on poses, in our analysis we were able to observe and classify shape-making patterns across the hundreds of participants who played during Nuit Blanche. While not the original focus of our research, taking this more abstracted view of *Tweetris* as an instrument for exploring WBI allowed us to derive several useful research outcomes, ones that were more in line with the opportunities for "micro-creativity" inherent in digital interactive art, as discussed in Chap. 9 ("Mutual Engagement in Digitally Mediated Public Art", Bryan Kinns 2014). More details about our evaluation methodology and results are available elsewhere (Freeman et al. 2013).

11.3.5 Lessons Learned

Our experiences with *Tweetris* illustrate the value of remaining flexible with research questions for HCI research at art events. While the strategy of aligning research questions with creative themes made sense, and might work for other projects, it did not work in our case. In *Tweetris*, the creative theme of collaboration vs. competition drove the evolution of the work, but most collaborative aspects were dropped late in the project.

Taking a more abstract view of the experience of playing *Tweetris* allowed us to identify a fruitful research approach. By viewing shape matching as a form of randomized repeated stimulus, research questions formed around an analysis of how players made shapes. The data being captured during the event was not optimized for such an analysis, however, leading to laborious manual classification work. HCI researchers interested in analysing interaction at this level of detail should ensure that they are recording all data produced by sensors and devices, so that analysis approaches identified after the event can be supported.

Our approach was to be intimately involved in both the creative process and the research design. This had the advantage of being able to respond to changes in the creative work quite rapidly, but also made data collection a challenge, since we were also heavily invested in the success of the exhibit, rather than being focused on executing a perfect study. Remaining flexible about research can be difficult to accomplish, especially when there are event deadlines and where there is a requirement to obtain research ethics approval for modifications to study objectives or methods. In the next section we discuss some of the issues regarding research ethics and public art events.

11.4 Ethical Ambiguities for the Artist/HCI Researcher

Conducting HCI research at a public art event raises important ethical issues. First, informed consent becomes difficult to acquire without unduly impacting the attendee's aesthetic appreciation and participation in the exhibit, as the exhibit becomes an experiment to them. Informed consent also implies engagement; attendees may feel engagement with the exhibit carries an obligation to interact with it for a certain length of time, or in a certain way. For these reasons, an HCI researcher is incentivized to delay obtaining informed consent, and even so, may want to avoid drawing the attention of others to the fact that some kind of evaluation is taking place.

For *Tweetris*, we waited until after attendees had engaged with the exhibit before approaching them with consent forms for participation in our study. A more pragmatic but related issue is that following protocol for obtaining consent and administering questionnaires, and doing so while not drawing attention of future participants, can be difficult in the midst of supporting a live, interactive exhibit—particularly when the same people running the exhibit are conducting the study. When

emergency situations arise (in our case flooring coming apart and needing to be affixed, and communication being lost between installations set up across town), this can limit the ability to conduct the study. As artists, the enjoyment of watching people engage with your work can also dissuade you from carefully following protocol for data collection. During Nuit Blanche, we gathered consent and conducted questionnaires for a portion of the evening only.

When conducting HCI research at public art events, we need to grapple with a tension between engagement in a public spectacle and the privacy of study participants. One of *Tweetris*' goals was to explore gameplay as public spectacle. Shape makers not only played in front of an audience, but a video stream of their interactions was prominently displayed in a public location, and their images made "playable" by Tetris players in the audience and made persistent and accessible to the public at large via Twitter. All attendees were made aware of these aspects of *Tweetris* before engaging in the shape making game. From the perspective of *Tweetris* as art exhibit, the shape making data was clearly in the public domain, and actively broadcasted, recorded, and used in a public way. When considering *Tweetris* as research instrument, questions of what resides in the public domain are not as clear-cut. Fundamentally, when one decides to participate in an art event that is clearly public spectacle, they do not also explicitly decide to participate in a study of their interaction. However, just as HCI research makes use of massive amounts of public domain data from social networks (like Twitter), or compiles observations of everyday activities in a public setting without informed consent, one might argue that the public engagement with art, insofar as this engagement resides within the public domain, is by definition available for HCI research without informed consent.

We believe that ambiguity emerges when those responsible for creating the experience also analyze its outcomes, a common situation for HCI researchers involved in public art projects. In a way this mirrors the model of the controlled experiment where one designs a study to answer research questions and then analyzes the results; and so a research ethics review seems necessary. However, the analogy to controlled experiment may not always apply. In our case, the design of *Tweetris* was not explicitly controlled by the research questions, and the researchers wore different "hats" before, during and after the exhibit, being key contributors to the creative process leading to *Tweetris*, and even making decisions that jeopardized the primary research question.

Perhaps more nefariously, the public art event may be viewed as a sort of "honey pot" (Hornecker et al. 2007), attracting people who might otherwise be difficult to recruit in a formal study, and providing a means of evaluating their interactions without obtaining informed consent or perhaps even without conducting a research ethics review. A counterargument is that a public art exhibit is more akin to an urban probe (Paulos and Jenkins 2005), as a spectacle that permits public observation, than to a formal experiment, and that they should be governed under similar policies.

Typically, observational studies of human behaviour in public do not require ethics review when they are *non-invasive* and *non-interactive*, such as when passively

Fig. 11.3 A tweeted pose snapshot

Fig. 11.4 Broadcast of shape making game

observing passers-by in a train station.[1] When an art piece defines rules of engagement it arguably does not allow for observation of unfettered public behaviour. The definition of "non-invasive" is particularly fuzzy for artworks, however. While *Tweetris* had specific gameplay mechanics, many attendees chose to instead play with the interaction more than to play the game. While we believe *Tweetris* in particular required ethics review, this may not be the case for more suggestive or contemplative interactive works.

Our ultimate position toward evaluation and informed consent in *Tweetris* became quite nuanced. We successfully made the case to our research ethics board that access to all broadcasted output should be available without informed consent, and that we should be able to record our general observations of the event without requiring consent from all attendees. Consent was required and obtained for those who filled out the *post hoc* questionnaire. We analyzed the shapes that were publicly tweeted regardless of whether an attendee was asked for consent, as these were

[1] For example, see Canada's Tri-Council Research Ethics Policy, article 2.3. Retrieved November 2013. http://www.ethics.gc.ca/eng/policy-politique/initiatives/tcps2-eptc2/chapter2-chapitre2/

available as public record (Fig. 11.3). We conducted a qualitative analysis of video-recorded gameplay for those attendees that signed the consent form. The entire stream was arguably in the public domain as it was a record of a public event which was itself broadcasted onto a public street (Fig. 11.4), however attendees were not informed that their interactions would be video recorded for later access. We used our recorded sensor data for quantitative aggregate statistics, such as the average duration of shape making engagements, and the percentage of successful shapes made for each tetromino type.

Human-subjects research guidelines at universities typically provide little explicit guidance for research at public art events, especially where these finer details are concerned. Indeed, in our ethics review we needed to be very clear about what we determined to be in the public domain (and why), and about our analysis procedure. We believe navigating the "grey areas" discussed in this section would benefit from clearer guidelines, particularly as this kind of research becomes more common.

11.5 Moving the Art and the Research Forward

We encounter opportunities to exhibit *Tweetris* at other venues with significant numbers of attendees. On face value this is an opportunity to iterate on our evaluation and research questions. We obtained an adjusted research ethics approval to conduct the same evaluation at similar public events rather than at the single Nuit Blanche event.

On reflection, conducting multiple evaluations at different venues poses unique challenges to HCI research. The first is that a venue can greatly impact on how an interactive work is perceived and engaged with (O'Hara et al. 2008). For example, we have found less willingness to engage with *Tweetris* at lab open houses and organized group demos than at Nuit Blanche. Even when the audience is as receptive, attributes of the event can change the experience: at a gaming conference the emphasis was on performance/demonstration during a presentation. The presentation went very well and engendered a great deal of performative play by audience members called up to try it out. However, when *Tweetris* was set up outside the conference room afterward, engagement by attendees was limited. As an art exploration at an interaction conference engagement was strong, but the venue was quite small, meaning that passers-by disrupted the gameplay and made data collection impossible. It is challenging to compare results in different venues, unless the impact of venue is the main factor in analysis.

Secondly, when exhibiting at other venues the artistic impulse to improve upon or change the exhibit can conflict with a need for experimental control. It is difficult, for example, to change an aspect of the work, evaluate it at a different venue, and compare results with the previous version evaluated at the first venue. Even where the venue stays the same or is largely similar, we must still contend with the desire to change the exhibit for aesthetic or experience-driven reasons, and consider how

Fig. 11.5 *Top*: Tweetris installation at Nocturne 2012, Halifax Canada. *Left*: shapes are made. *Center*: shapes are tweeted. *Right*: shapes are fed to body-controlled Tetris

this will impact evaluation. HCI researchers working in this area need to accommodate the artistic desire for change.

Finally, conducting research involving an interactive artwork that is evolving and is exhibited at multiple venues requires careful management of research ethics. We successfully petitioned for a research ethics amendment to cover repeated installations of the exhibit at different venues; however the assumption was that the exhibit and experimental protocol would not change. We significantly reworked the *Tweetris* exhibit in the year following Nuit Blanche, so that instead of playing Tetris with the tweeted body shapes on a mobile device, individual players used their own bodies to control a giant game of Tetris using the shape-images as tetrominos. We exhibited this new variant at the Nocturne: Art at Night festival in Halifax, Canada in October 2012. The shape-matching game took place in a van with exactly the same specifications as in Nuit Blanche, to facilitate comparison between the two events. Winning shapes were still tweeted as before, but they were also displayed to the crowd outside via a projected TwitPic feed (Fig. 11.5).

The new Tetris game was projected onto a white tarp covering a building face on a busy street, giving a 30-ft game board visible from about one block away. The tetrominos were a mix of coloured blocks and the shape-images made in the shape matching game. A stick figure was placed on the game board showing the movements being made by the player to control the game. Moving from left to right moved the active tetromino in the same direction, crouching down on the ground caused the

tetromino to speed its descent, and using the arms to make a broad rotating motion clockwise or counterclockwise caused the tetromino to rotate in the same direction. We were required to submit a new research ethics application for this installation. Most changes involved the new Tetris game, however we needed to consider how the new context (the TwitPic feed and large projected Tetris game) altered the "public" nature of participation in the original shape matching game (Reilly et al. 2013).

Now that *Tweetris* has been exhibited multiple times, we have been able to reflect on some of our research questions from a more qualitative perspective. Specifically, our exploration of how setting and audience influence shape-making behaviour was originally focused on quantitatively measuring the relationship between behaviour (counts of body orientations, amount of kneeling) and setting (location of audience, size of play space). Exhibiting at a range of types and size of venue has provided a richer understanding of how setting influences behaviour. We have seen the influence of a range of factors including weather, exhibit scale and layout, and event characteristics, and have been experimenting with different analytic approaches (e.g., the social-spatial semantics approach proposed by Lainer and Wagner (1998)) to understand these factors.

11.6 Conclusion

Tweetris is a project with both artistic and scientific goals. As an interactive artwork exhibited at public events, it provides an opportunity to observe whole-body interaction in environments where visitors are seeking novel experiences, rather than in a sterile lab. The repeated stimulus of tetrominos in the shape matching game allows us to analyse interaction both quantitatively and qualitatively, and showings at events with different characteristics allow us to build understanding of the impact of venue on engagement with *Tweetris*.

We encountered three key challenges in marrying the artistic and scientific goals of *Tweetris*. First, we needed to be flexible when setting research questions: *Tweetris* as artwork needed the freedom to evolve, right up to the days before its first public showing. Second, we encountered a number of ethical considerations, both during the event and in analysis. As a public art exhibit of our own design, we entered relatively uncharted and murky territory when seeking research ethics approval, particularly regarding what constituted public domain. Finally, we had to continue to manage scientific and artistic aims as we evolved *Tweetris* and exhibited at other events. While we were able to observe the impact of venue on whole-body interaction with *Tweetris*, factors such as lighting, space, and visitor engagement made it difficult to achieve enough consistency to conduct detailed comparative evaluations of whole-body interaction behaviour between venues. We also need to reflect, on an ongoing basis, on how changes to the exhibit impact our research ethics requirements.

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References

Bengler B, Bryan-Kinns N (2014) In the wild: evaluating collaborative interactive musical experiences in public settings. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 169–186

Bryan Kinns N (2014) Mutual engagement in digitally mediated public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 123–138

Csikszentmihalyi M (1990) Flow: the psychology of optimal experience. Harper & Row, New York

Edmonds EA (2014) Human computer interaction, experience and art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 11–23

Freeman D, Chevalier F, Lapierre N, Reilly D (2013) Tweetris: a study of whole body interaction at a public art event. In: Proceedings of ACM creativity and Cognition Conference (C&C'13). ACM, Sydney

Holland S, Wilkie K, Bouwer A, Dalgleish M, Mulholland P (2011) Whole body interaction in abstract domains. In: England D (ed) Whole body interaction, Human-computer interaction series. Springer, London, pp 19–34

Hornecker E, Marshall P, Rogers Y (2007) From entry to access: how shareability comes about. In: Proceedings of the 2007 conference on Designing Pleasurable Products and Interfaces (DPPI'07). ACM, New York, pp 328–342

Johnston A (2014) Keeping research in tune with practice. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 49–62

Lainer R, Wagner I (1998) Connecting qualities of social use with spatial qualities. In: Proceedings of CoBuild'98. Springer, Heidelberg, pp 191–203

Nijholt A, Pasch M, van Dijk EMAG, Reidsma D, Heylen DKJ (2011) Observations on experience and flow in movement-based interaction. Springer, London, pp 101–119

O'Hara K, Glancy M, Robertshaw S (2008) Understanding collective play in an urban street game. In: Proceedings of the 2008 ACM conference on Computer Supported Cooperative Work (CSCW'08). ACM, New York, pp 67–76

Paulos E, Jenkins T (2005) Urban probes: encountering our emerging urban atmospheres. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'05). ACM, New York, pp 341–350

Reilly D, Freeman D, Chevalier F, Lapierre N, Neil D, Patel J (2013) Mammoth Stickman plays Tetris: whole body interaction with large displays at an outdoor public art event. CHI 2013 Workshop on experiencing interactivity in public spaces, Paris, France

Wobbrock JO, Morris MR, Wilson AD (2009) User-defined gestures for surface computing. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'09). ACM, New York, pp 1083–1092

Chapter 12
In the Wild: Evaluating Collaborative Interactive Musical Experiences in Public Settings

Ben Bengler and Nick Bryan-Kinns

Abstract This chapter describes a mixed-method approach that was adopted for evaluating the audience interaction with a collaborative interactive music system entitled *Polymetros*. Designed for broad audiences, *Polymetros* aims to enable users without formal musical training to experience collaborative music making. The presented approach aims to cater for audience evaluations that take place in the real-world context of a public exhibition and was applied to a study conducted in the Victoria and Albert Museum in London. Besides reflecting on general motivations for adopting and combining different methods to assess technology-mediated public creativity, the main focus of this chapter is to provide a detailed account of how the specific contextual demands and particular evaluation objectives of the reported study were incorporated into the methodological approach. After summarising the study results, several interesting links between findings derived from using different methods are examined indicating the value of triangulation. This leads to a discussion how a bespoke mixed-method approach can contribute to the understanding of such a complex, interactive multi-user scenario in public settings.

12.1 Introduction

The presented methodological approach evolved as part of a research project that investigates ways to transfer the traditionally rather exclusive experience of musical collaboration to broader audiences using interactive technology. The main objective is to enable people without formal musical training to experience collaborative music making in order to understand and identify key factors and strategies that are relevant

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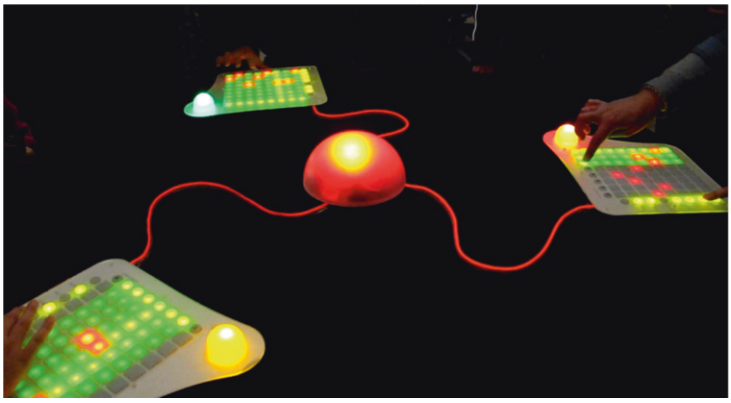

Fig. 12.1 *Polymetros* is an interactive, collaborative music system inspired by minimalist composing techniques. Via their own instrument, each player can contribute individually to the collaborative musical creation

when designing such new interactive collaborative experiences. With collaborative musical experiences we refer to musical 'interactives' that focus on the creative process of making music as an end in itself by thinking of music-making as an enjoyable group activity rather than an expert profession. An important project goal was to create an interactive experience that actually reaches out to broad audiences and allows for immediate, walk-up and play interaction in public settings.

As part of this project, we developed the interactive music system as an audience experience for exhibitions, festivals or public workshops (Fig. 12.1). The design was based on our findings of a comprehensive literature review assessing existing collaborative music systems for novices. A key finding, which became a main concept in our design approach, relates to the notion that feeling part of a collaborative, creative musical process seems closely related to the *sense of control* that each participant has over his or her particular contribution. This posed the challenge of how to balance a deep level of interactivity to open up real possibilities for musical creation while allowing every participant to experience an individual sense of musical control; at the same time we wanted players' contributions to blend together in an interesting and musically coherent way. We addressed this issue by pursuing a design strategy that was inspired by specific properties and composing techniques of Minimal Music. All players are provided with their own physical instrument that gives them full control over one repetitive musical pattern becoming their very personal musical contribution. Every player can create and develop an individual phrase, play with tempo, time signature or metrical shifts inspired by minimalist composing techniques via the instrument's grid-based interface. Even though each individual musical contribution is rather simple in itself, the dynamic interplay between them leads to interesting, complex and constantly evolving musical structures. A more detailed description of the design rationale and system design can be found in (Bengler and Bryan-Kinns 2013).

The primary concern of this chapter is to give a detailed description of the reasoning that led to our particular evaluation approach and, in doing so, to provide insights into methodological as well as practical aspects and implications of such a mixed-method strategy.

12.2 Methodological Background

12.2.1 Why "In the Wild"?

The focus of this project was on technology-mediated, collaborative music making 'in the wild' of public settings ('in vivo'). This necessitated a high quality execution of the interactive system providing a high degree of robustness for reliable use in public venues. After a stage of initial user testing, we aimed to create a musical interactive system that conveys the appearance and fidelity required of real-world exhibition contexts, such as an established art museum. This was driven by a strong interest in assessing and learning about new interactive environments that aim to foster public creativity in accordance with the belief that the user's experience of a technology is considerably influenced by the context of its use (Blomberg et al. 1991; Mackay and Fayard 1997). However, as we were not only interested in the technological aspects of the user interactions, but also in the accompanying social dynamics, a contextual approach seemed even more sensible. It is arguable also that the users' social behaviour is significantly influenced by the context and that, conversely, removing them from the larger social context leads to change in behaviour "in nontrivial ways" (Blomberg et al. 1991). Therefore, we consider laboratory-based approaches of limited value when dealing with technology-mediated public creativity. Heath and vom Lehn (2008, p. 85) point out the inadequacy of assessing interactive exhibits "without taking into account the contingencies that emerge in actual museum spaces".

These considerations call for the use of ethnographic practices. A primary goal when examining such new forms of interaction involving social and technological factors is to develop an understanding of how the people behave and interact in these situations within a real-world context. Combining ethnographic methods such as field notes, interviews and video observations can lead to a rich set of data serving as a source for developing such a situational understanding. Moreover, in contrary to lab-based settings, the contextual approach enables the observation of the interactions of large numbers of people; this implies the possibility of identifying patterns of audience behaviour (Bilda 2011). Adding this systematic dimension allows for comparing findings of similar studies and assessing their general applicability while leading to a deeper understanding of the studied interaction scenarios. This understanding is a key resource for informing related works and future designs. However, as pointed out in Chap. 13 ("Evaluation in Public Art: The Light Logic Exhibition", Alarcon-Diaz et al. 2014), the focus of an audience evaluation is also

largely dependent on the particular aims and motivations of its conductors. In the following section, we want to illustrate how we incorporated practical demands and our particular research objectives into the evaluation strategy.

12.2.2 Incorporating Research Goal and Practical Demands

When conducting research in the wild we have to accept that we need to give up some degree of control in comparison to a laboratory environment. In terms of a public museum, this means complying with aesthetic standards and practical demands and being responsive to institutional concerns and regulations. Examples include spatial constraints, restrictions in terms of the system feedback (e.g. sound level) as well as issues related to ethics and health and safety. Moreover, it is important to keep in mind that from a curator and visitor's perspective, the studied artefact is primarily considered as an exhibit while our research interests might have no direct relevance to them. Therefore, we have to consider carefully to what extent we want to 'interfere with' these expectations when conducting our research (see Chap. 11 ("Blending Art Events and HCI Research", Reilly et al. 2014) for another perspective on the challenges of blending research with active art exhibitions).

In the particular case of the reported study, we were invited to exhibit at the Victoria and Albert Museum (V&A) in London during its Digital Design Weekend 2012. This annual 2-day event is dedicated to digital art and design, including interactive installations, performances, demonstrations and workshops. Incorporating an open studio-like atmosphere, most of the exhibiting artists attend the event in order to demonstrate and discuss their work with audiences. We were granted permission by the organisers for handing out questionnaires, conducting interviews and video recordings after getting approval and advice by our university's research ethics commission. General contextual demands were the limited overall time frame (2 days, 7 h each), the rather small allocated space and very limited times for setup and dismantling.

The main objectives of the audience evaluation were twofold: first, to inform a general understanding of how people engage and interact with such a collaborative interactive experience in a public setting and second, to examine and assess the particular design in relation to its underlying rationale. The former goal was addressed by adopting ethnographic practices as described in Sect. 12.2.1 above. The second objective, by contrast, demanded a rather selective approach by eliciting more specific responses in relation to the users' system interaction and their perceived experience. For this purpose, we devised a self-report questionnaire as described in Sect. 12.3.2 and a framework of themes and questions for semi-structured interviews. However, due to the high visitor density over long periods of the exhibition, along with the lack of alternative spaces to be used for interviews, providing a reasonable amount of privacy, conducting semi-structured interviews on site was not feasible. In addition, user-system interaction data were collected via a logging mechanism built into *Polymetros* to capture how they used the instrument's interface and what kind of musical patterns they created. This approach was

motivated by the prospect of complementing interface-specific observations and our interest in examining relatedness (or 'unrelatedness') between the users' self-reported responses and their actual interaction with the system.

12.3 Methods and Data Collection

The following section provides a detailed description of the methods used. We applied a mixed-method approach combining questionnaires, interaction logs, field observation and video analysis. Additional contextual and demographic data were gathered from audience monitoring and evaluation reports conducted by the V&A. Prior to the work described here, a pilot study was conducted during a public 3-day open studio event at the authors' university as part of the *Digital Shoreditch Festival 2012*. The pilot allowed us to evaluate options and feasibility of data collection mechanisms whilst also highlighting interesting aspects of the users' interaction, which we then focussed on in the main study. In addition, the pilot was used to expose software defects and test the system's hardware and software components in a realistic scenario during long-term operation, helping to improve the robustness of the system.

12.3.1 Study Setting

Polymetros was installed in a slightly darkened studio space alongside several other interactive and static artworks that required dimmed lighting. The available space was limited to an area of 3 by 3 m. The system was positioned in such a way as to be approachable from all sides (Fig. 12.2). Even though it was the only exhibit that incorporated sound in its immediate vicinity, the overall noise level was rather high due to the event's open studio character. The originally intended output volume had to be lowered to ensure that the sound was not audible in adjacent areas. The user interaction was video recorded from two different angles.

The study was conducted with the help of two assistants. This enabled the researcher to focus on contextual observation and note taking whilst monitoring the system execution. The collaborators conducted and coordinated the data collection and provided visitors with some initial guidance and the research team was also available to answer specific questions and discuss the exhibit with interested audience members.

12.3.2 Experience Questionnaire

The questionnaire was designed to probe participants' self-rating of different aspects of their playing experience. It was handed out by a member of the research team immediately after visitors finished playing; the forms were also available on a pedestal and a number of questionnaires were filled in on visitors' own initiative.

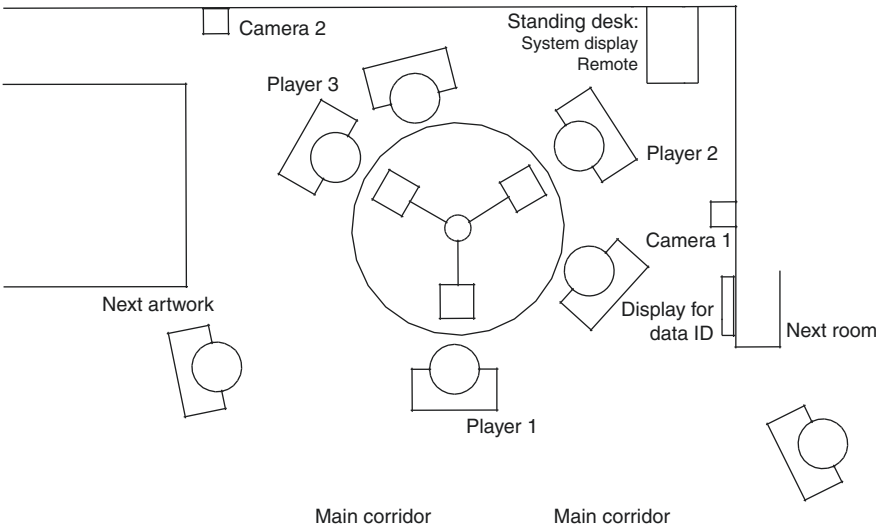

Fig. 12.2 Study setup in the V&A

Table 12.1 Questionnaire Items

S1:	I am a musical person
S2:	I am experienced using interactive devices (e.g. smart phone, tablet, video gaming)
E1:	I felt part of a creative process
E2:	I felt in control
E3:	I felt connected to the other players
E4:	It was challenging
E5:	I liked the music we created
E6:	My playing was influenced by the playing of the others
E7:	I would recommend playing to my friends

The questionnaire was designed to be completed in a short amount of time (1–3 min) and was printed on A5 format paper. This small form factor was deliberately chosen to convey a casual, flyer-like appearance that visually indicates a short time of completion. Larger formats and the use of clipboards were avoided in case these might discourage visitors from approaching. The questionnaire was composed of nine Likert-type items to be rated on a 5-point scale. The questionnaire items are listed in Table 12.1. The qualifiers of the response categories were:

not at all – slightly – moderately – fairly – very much

For the sake of clarity these qualifiers were repeatedly stated below the corresponding tick boxes for each individual questionnaire item. In addition, the participants were asked to indicate their age and gender. The back of the questionnaire contained an explanation of research project and its objectives as well as a statement relating to the confidentiality of the collected data. The respondents were asked to give written consent to the processing of the data for the purposes of this study.

The first two statements asked the respondents to rate their musicality and experience with interactive technology (S1, S2). In combination with the collected demographic information, these statements were designed as descriptive attributes for the studied group indicating their task-related abilities. The following seven items relate to how the participants perceived their actual playing experience. These aimed to capture a sense of participation and collaboration (E1, E3, E6), a sense of control and perceived challenge (E2, E4) and satisfaction with interaction and overall experience (E5, E7). The item design was informed by questionnaires that assess the experience of technology-mediated, musical collaboration (Bryan-Kinns and Hamilton 2009; Bryan-Kinns 2013) and digital game enjoyment (Ijsselsteijn et al. 2008; Poels et al. 2008).

Both questionnaires take into account the social dimensions of interactive experiences as well as the concept of *Flow* (Csikszentmihalyi 1990). As introduced by Csikszentmihalyi, Flow describes a positive experience characterised by deep enjoyment often related to creative activities. A basic aspect is that flow experiences are likely to emerge if a person perceives itself as successful in performing tasks that require particular skills. Csikszentmihalyi (1975) considered the *perceived sense of control* as one of the most important components of such an experience. Studies investigating Flow during computer work tasks indicated a close relation between flow experiences and an individual's sense of being in control as well as links between Flow and exploratory user behaviour and perceived creativity (Ghani 1995; Ghani and Deshpade 1994). These aspects correspond closely to the design rationale of *Polymetros* and its focus on supporting a strong sense of individual control while encouraging creative exploration by offering a deep level of interactivity.

12.3.3 Data Logging

One member of the research team was in charge of controlling the data logging mechanism which was directly integrated into the system. Via a remote control he controlled the data recording in relation to the period of time a participant spent playing with an instrument. Each log contained all input data made via the instrument's interface. For each individual log, a non-ambiguous, numeric, colour-coded ID was created. The most recent two ID codes of each instrument were displayed on a 19-in. monitor which was placed near the wall being clearly visible for all members of the research team. This allowed the assistant handing out the questionnaires to mark collected surveys with the corresponding ID if a log file has been created for this particular user. In this way, 63 of the 150 completed questionnaires could be allocated to their corresponding set of interaction data.

12.3.4 Field and Video Observations

Direct observations were carried out for several hours on both days of the exhibition. They were mainly conducted from a standing desk located in the corner of the room, which was also used to monitor the system functionality via a nearby computer

display. Field notes were taken by the researcher referring to specific playing experiences of one or several audience members as well as events and activities of interest in the surrounding area. Beside participants' actions, the records included related gestures and behaviours such as laughing or head nodding as well as estimated age, gender and the corresponding ID code if available. The close proximity to the users also allowed for noting down verbal statements including spontaneous outbursts of players, communication between audience members and comments made to the research team. After the study, the handwritten notes were transcribed and compiled into a report and observed actions and occurrences were classified into categories such as playing behaviour or verbal responses.

In order to complement the field notes and examine specific aspects in greater detail, 5 h of the recorded video material were examined and annotated. In contrast to the field observations, the analysis of the video recordings enabled more detailed and long-term observations of how participants used their instrument's interface and what kind of musical contributions they created. The second major focus of the video analysis were instances of interest that unfolded over a longer period of time such as a visitor's transition from an observer to an active player (cf. Sheridan and Bryan-Kinns 2008) or the timeframe just before an audience member quit playing. In addition, all relevant verbal data recorded by the camera-mounted microphone were transcribed.

In summary, the data collection encompassed questionnaires, field notes documenting direct observations, video recordings and user-system interaction data. Matching the collected questionnaires with the recorded user-system interaction data via the ID display demanded a high degree of attention and coordination from the executing research assistants. Due to the crowded setting and frequent quick changeovers of players the assistant controlling the data logging was not able to monitor and log all participants joining in and leaving the installation. In total, 63 of the 150 questionnaires could be collated to their corresponding interaction data. At the beginning of the data analysis we checked how the questionnaire responses of the matched data set (n = 63) deviate from the full data set (n = 150). As the matched subset showed very similar distributions and identical medians for all items, we considered it to be a representative sample and so did not differentiate when reporting the findings.

12.4 Study Results

The following section presents the findings of the audience evaluation gained from analysing the different types of collected data. The questionnaire responses were analysed and represented using descriptive statistics. System-related and social interactions with and around *Polymetros* are based on the observational findings from analysing field notes and video data as described in Sect. 12.3.4 above. For analysing the logged user-system interaction data we devised a pattern recognition tool that was informed by observed playing and input strategies.

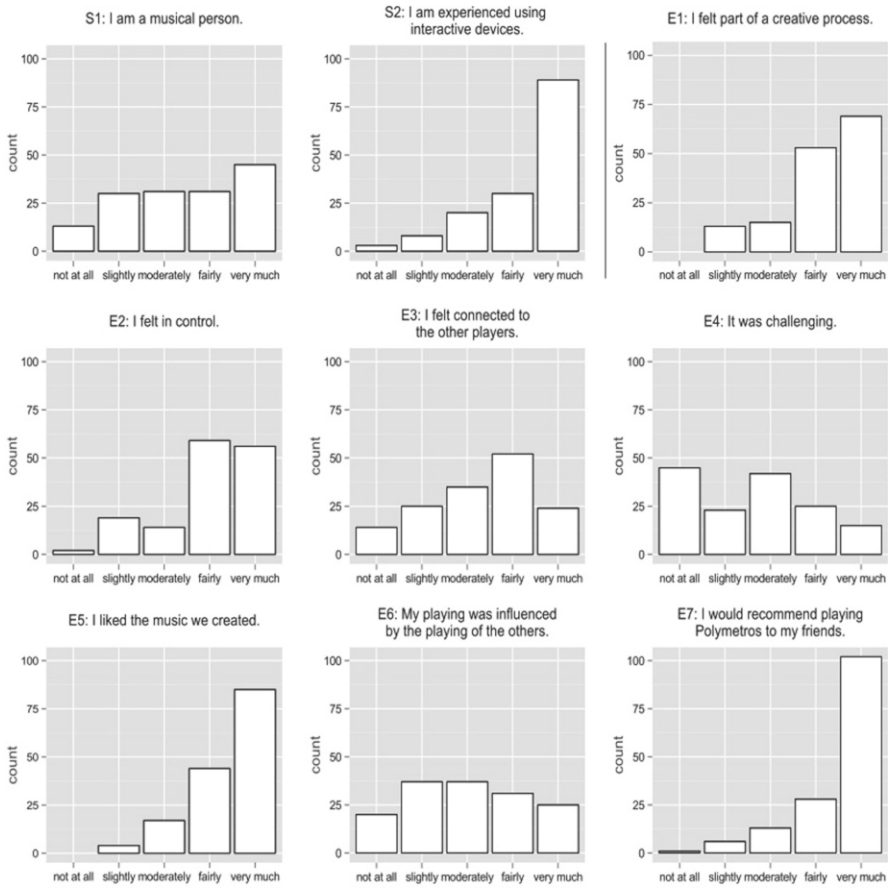

Fig. 12.3 Questionnaire results (n = 150). Each survey item is represented as an individual bar chart showing the frequencies for each response category

12.4.1 Experience Questionnaire

During the two days of the exhibition the questionnaire was filled in by 150 participants (82 female and 68 male) from ages 5 to 66 (M = 24.3, SD = 14.1). The age range corresponds closely to the result of the event's visitor profile conducted by the V&A indicating 67 % of the audience in the 16–34 year group (n = 67) (Bentley 2013). The questionnaire data are shown in Fig. 12.3.

While the self-rating of the participants' musical abilities is distributed over a wide range (S1), the majority of them considered themselves as experienced users of interactive technology (S2). Visual inspection of the experience-related items

shows that most participants evaluated their playing experience as very positive: Designed to rate their overall satisfaction in an indirect way, 102 of 150 respondents stated they would very much recommend playing to their friends (E7). In addition, the majority of participants indicated that they were pleased with musical result (E5). The high rating of 'feeling part of a creative process' (E1) along with the relatively high rank of 'feeling connected to the other players' (E3, median = fairly) suggests a commonly experienced sense of shared creative participation. High ratings referring to the players' feeling of control (E2) indicate that the majority of users perceived a strong sense of personal control when interacting with *Polymetros.*

For exploring potential associations between individual survey items, we used the Goodman and Kruskal's gamma coefficient as a dedicated measure of associations between ordinal variables with relatively few categories. In order to identify whether the feeling of being in control is related to other perceived qualities of the playing experience, we calculated the gamma coefficient for several combinations. We found highly significant associations between 'feeling in control' and 'feeling part of a creative process' (gamma = 0.56, $p < 0.0001$), 'feeling in control' and 'recommend playing to friends' (gamma = 0.50, $p < 0.0001$) and 'feeling in control' and 'feeling connected to other players' (gamma = 0.43, $p < 0.0001$). These findings indicate that experiencing control is related to other perceived qualities of the participants' experience. This supports the main claim that informed the design of *Polymetros* being that the perception of personal control is associated with enjoying and feeling part of a creative musical process.

12.4.2 System Interactions

Over the two-day period of the exhibition, *Polymetros* demonstrated a strong appeal to the audience. Most of the time all three instruments were in use, and the players were usually surrounded by a number of spectators. This situation established an area of interest that attracted passing visitors to take a closer look at *Polymetros,* the majority of which stayed to interact with it. Brignull and Rogers (2003) reported a similar social dynamic in relation to public interactives referred to as the 'honey pot effect'.

In a rather crowded setting, people appeared to learn how to use the instruments by watching previous players. Several audience members were observed performing well-directed actions immediately after they took over one of the instruments, showing a prior understanding of the interface. Only complementary features such as loop length or tempo selection had to be explained by the facilitator. Generally, we found that the majority of visitors understood the interaction concept when given short guidance. However, due to the rush of people over long periods, it was not possible to provide initial guidance to all newly arrived players. While many visitors were able to discover the relevant aspects of their instrument on their own, a number of audience members could be observed having difficulties in

understanding the interface. These seemed to be mainly related to a lack of understanding of the interface's loop-based concept, as suggested by observations of inappropriate input gestures in relation to the sequential playback of the instruments grid. In general, however, *Polymetros'* physical interface successfully promoted understandability for both the surrounding audience and the players. In contrast to screen-based multi-user exhibits, which have been criticised for excluding the surrounding audience from understanding the interaction with the system by undermining "mutual and public visibility of conduct" (Heath et al. 2002, p. 29), the physical LED-based interface provided a highly visible representation of interaction. This allowed spectators to observe the players while giving the participants visual access to their co-player's actions.

A key experience for many participants was the moment of realisation of 'how it works', which could be observed when a hint given by the facilitator or a co-participant led to understanding the instrument's functionality. Accompanied by a sudden recognition of their instrument's 'voice' in the overall music, many participants reacted to this understanding with a facial expression of excitement or spontaneous outbursts. This particular moment of insight or 'aha moment' (cf. Csikszentmihalyi 1996) could be described as the 'This is me! experience'.

In several cases, the similar sound characteristics of the different instruments appeared to cause difficulties for the players in identifying their pattern in the overall musical output. The reason for choosing either mallet or pitched percussion-based sounds for all instruments was motivated by the fact that these are well qualified to be transposed over a very wide pitch range having a versatile sound characteristic: It ranges from drum-like sounds in low registers to bright, bell-like sounds in high registers. This design choice aimed to enable all players to modify their phrase without restrictions over a wide pitch range. But as a consequence, the instruments sounded quite similar when played in the same octave register. While this finding suggests that it may be better to use more distinctive sounds restricted to certain pitch ranges, this would come at some cost, as it appeared that many players particularly enjoyed 'shifting around' their phrase over a wide octave range in a dynamic manner providing immediate and salient acoustic feedback.

12.4.3 Social Interactions

Despite the fact that the interaction with the *Polymetros* appeared to be appealing and very enjoyable for the participants, it should be noted that collaborations involving *active engagement* between 'instrumentalists' were rarely observed during the reported study. By active engagement, we refer to situations where players coordinate their efforts in a systematic way in order to collaboratively develop the musical outcome over a certain period of time. However, we observed several occasions when players commented on their actions or discussed their playing activities across the table. In all these cases, the participants appeared to know each other as friends, couples or family members. In addition, playing techniques such as muting ones

instrument rhythmically in relation to another pattern, which could be observed several times during the study, showed an explicit awareness of other players' contributions. But unlike in the pilot study, where several groups were actively 'performing' together, such attempts involving all players were not observed during this case study.

Reviewing the video material of the pilot showed that actively coordinated collaborations mainly took place if audience members who were already acquainted approached *Polymetros* whilst it was not in use. In such cases, we observed that groups split up to play on different instruments, explore the system together and develop strategies to coordinate their actions via verbal and non-verbal communication. This approach also seems to promote mutual awareness and interest for the co-players' actions. However, due to the high visitor turnout at the V&A, new players usually joined in an ongoing musical process individually rather than exploring the system together. Most of all, not knowing other players appeared to be the main barrier to actively engaging with them in order to jointly coordinate the musical outcome.

Reflecting on these findings made us aware that from a visitor's perspective 'active collaboration' might not be a necessarily relevant or desirable aspect in the context of such a highly frequented, public setting. However, it is interesting to note that despite the limited degree of active engagement observed between different 'instrumentalists', half of the respondents stated in the questionnaire that they felt either fairly (34.7 %) or very much (16 %) connected to the other players. This indicates that many audience members experienced their playing as a joint activity even though they did not directly communicate with other players.

It was very common for familiar audience members such as friends, family members or couples to choose to play together on a single instrument when approaching *Polymetros*. Facilitated by the interface's physical and tactile properties, they were likely to explore their instrument together by explaining the interface to their companion, co-editing a musical pattern or commenting on each other's actions. These observations correspond to findings of vom Lehn et al. (2001) that interactive exhibits are often examined by visitors in interaction with their companions. Such commonly observed co-participations on a shared instrument appeared to be a highly social and collaborative activity in itself.

12.4.4 Dwell Time and Context

We examined factors that influence the time how long audience members actively engaged with the system. In the context of museum evaluations, this time period is often referred to as *dwell time*. In our case, we defined dwell time as the duration a participant was actively interacting with one of the instruments. Based on 294 interaction logs, the average dwell time was 3.3 min.

Using the matched data set as described in Sect. 12.3.3, we explored the relationship between the participants' dwell times and their questionnaire responses by

calculating the Kendall's tau correlation coefficients as a measure of association between ordinal variables (few categories) and interval variables (many categories). Taking into account the items 'process' (E1), 'control' (E2), 'like' (E5) and 'satisfaction' (E7) showed no association between the respondents' dwell time and how they rated such aspects in the experience questionnaire. This finding raised our interest in examining what factors were likely to be relevant for the participants' dwell time in the specific scenario. Therefore, we devoted particular attention to this aspect during the video analysis.

The video observations indicated that the players' dwell time was considerably influenced by the high visitor turnout during the study. It appeared that people were likely to quit playing and leave their instrument if they became aware that another audience member was waiting in their direct vicinity. In such a situation many audience members feel an obligation to leave in order to make room for other visitors. This is supported by the fact that the average dwell time of 3.3 min (n = 294) approximately corresponds to the dwell time measured on the opening evening of the pilot study, where the system was similarly highly frequented (3.8 min, n = 92). On the two following days of the pilot, which were much less well-attended, the average dwell time increased to 6 min (n = 72). It could also be observed that several visitors appeared to quit playing merely because their companions were moving on. These findings suggest that the participants' dwell time was likely to be determined by contextual and social factors rather than their individual playing experience.

12.4.5 Interaction Strategies and Data Analysis

An interaction strategy that could be widely observed was the creation of musical patterns characterised by simple geometric properties. The most common phrases consisted of horizontal and upward or downward diagonal 'lines' whereas in most cases all available notes were used (Fig. 12.4). Resulting in 'closed musical figures', this approach was applied by large numbers of players during the study. Initiated by these observations, we devised a data analysis tool to examine how this observed interaction strategy generalises across all recorded interaction data.

In order to get a quantitative overview of the extent to which the observed structural properties can be retrieved from the collected data set, we conducted a data analysis using a pattern recognition approach. Based on our observations, 'closed musical figures' were defined as sequences of successive notes that either have the same pitch or the next higher or lower pitch in the chosen scale (scale step). The other categories of the pattern recognition were 'open figures' and 'no notes'. 'Open figures' refers to sequences where the distance between consecutive notes is bigger than one scale step while 'no notes' relates to rests or longer periods without notes. Aiming for a general overview, the analysis of all 294 interaction logs showed that 54 % of the musical contributions were organised according to the properties of 'closed musical figures' ('open figures': 24 %; 'no notes': 22 %). In contrast to the

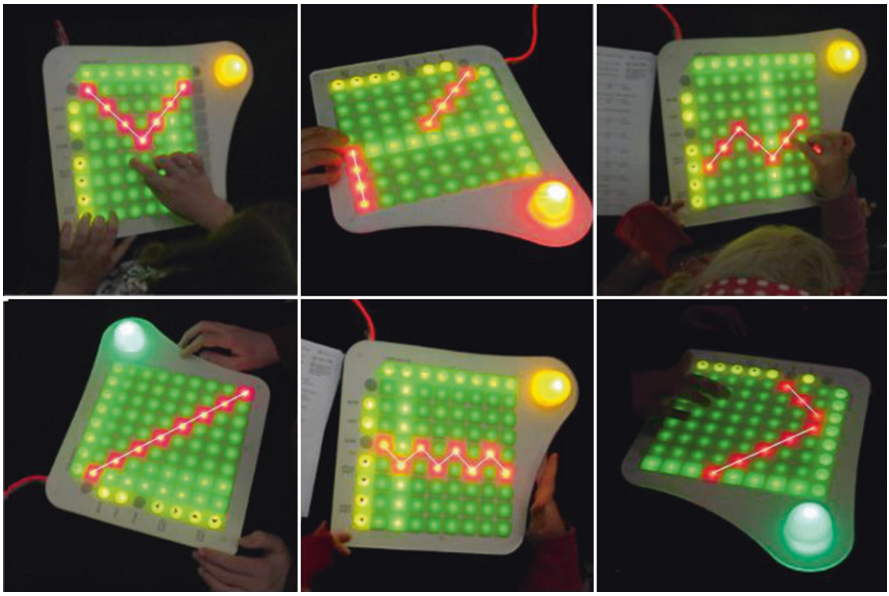

Fig. 12.4 Typical musical contributions

approach described in Chap. 9 ("Mutual Engagement in Digitally Mediated Public Art", Bryan-Kinns 2014), we developed our categories of patterns from observational analysis of use, whereas Bryan-Kinns' visualisations were concerned with clustering participants' contributions based on musical features in order to identify patterns of participant behaviour.

A more specific observation relating to these 'closed musical figures' is that these appeared to have an important role for explaining 'how it works'. In various cases, audience members could be observed using this input strategy to explain *Polymetros'* functional principle to their co-participants. By creating a preferably simple closed figure, such as a sequence of consecutive notes in ascending order being played back continuously, they illustrated the instrument's musical output by pointing the finger at the currently sounding note on the grid. In this way, they 'augmented' and highlighted the instrument's visual feedback which indicates the currently sounding note via a horizontal light bar 'travelling' over the grid in time with the music. By making the audio-visual relationship between a pattern's representation on the interface and its musical result as clear as possible (e.g. ascending 'line' leads to ascending melody), this strategy appeared to be the most common and successful way to communicate the functionality and underlying concept to others. In addition, several audience members were supporting this demonstration by humming along with the played pattern.

In general, it appeared to us that the players' overall preference for 'closed musical figures' was related to the fact that for many people, such figures were easier to identify within the overall musical outcome compared to more 'sparse' or

complex patterns. Often such phrases were modified in an incremental manner by changing just a single event per playback cycle. This strategy suggests a systematic attempt to create distinct alterations that provide clear feedback affirming of the users understanding of the interface. Initiated by these observations, we used the matched data set ($n = 63$) to examine if this clearly organised interaction strategy of 'closed figures' relates to the participants' perceived level of control during their playing experience.

Calculating the Kendall's tau correlation coefficient indicates a significant correlation ($tau = 0.20$, $p < 0.05$) between the players' reported level of control and to what extent they organised their contributions as 'closed figures'. Along with the findings from direct and video observations as presented above, this suggests a mutual relation between this particular interaction strategy and the players' experience of control. Uncovering such tendencies by observing large numbers of participants provided insights into how people appeared to understand and experience their interaction with *Polymetros*. In particular, observations of the way audience members explained the interface and interaction to others revealed their understanding of the system and provided valuable information about how to facilitate the playing experience in the most effective way. In subsequent presentations of *Polymetros*, we successfully adopted the observed explanation strategy based on simple 'closed musical figures' when delivering short initial guidance to new players.

12.5 Discussion

In the following section we discuss the evaluation approach with emphasis on how the selected methods relate and contribute to the main goals and findings of the reported study.

In general, our study highlights the significant influence of the public exhibition setting on the participants' ways of interaction, both with the system and with other members of the audience. It further emphasises the importance of supporting each player's sense of control. The study indicates that sense of control relates to other perceived qualities of the participants' playing experience such as feeling satisfied with the overall interaction or feeling part of a creative process.

In terms of the context-related findings the adopted ethnographic practices proved to successfully foster an understanding of the situated social and system-related interactions. In particular, the observations of large numbers of audience members along with the video observations provided confidence in our context-related findings. We also paid close attention to how our findings correspond to related approaches investigating social interactions around non-musical interactive installations and systems in public exhibition spaces. As an example, our observation that participants were likely to co-participate by sharing a single instrument relates to findings that audience members often explore and experience public interactives in collaboration (vom Lehn et al. 2001) while discussing their actions and 'scaffold' each other (Hornecker and Stifter 2006).

In contrast to using observational methods for studying social interactions without technology involved, investigating technology-mediated interactions provides the additional possibility to quantify certain aspects of the participants' system interaction via capturing related data. The reported study highlighted the potential of this type of data to inform, support and complement contextual observations as well as other methods such as self-report measures. One example is the observational finding that many participants appeared to feel 'obliged to leave' when becoming aware of someone waiting in their direct vicinity that was supported by the changes in dwell time in relation to high and low rates of attendance. This also links in with the fact that the participants' playing time did not correlate with how they rated their experience in the questionnaire.

Moreover, the analysis of the interaction data enabled us to demonstrate that the observed interaction strategy of 'closed musical figures' was identified across the majority of audience members. This illustrates how such interaction data are likely to gain their real value primarily *through* the observations and that they may be misinterpreted without situated contextual information. By indicating patterns of interest, the observations reveal how to harness the gathered data in ways that contribute to the particular research interests. In accordance with Hornecker and Stifter (2006), we argue that examining links between audience observations and interaction data can significantly inform the overall analysis and contribute to the validity of findings. Beside that, matching the questionnaires with the corresponding interaction data allowed for examining relations between participants' responses and their actions. As an example, the indication that the players' preference for 'closed musical figures' relates to their sense of control complemented our observations regarding the significance of this particular strategy for individual playing and participants' attempts to 'make' others feel in control when explaining the instrument to them.

On a practical level, the presented study illustrates the need for flexibility when conducting audience evaluations in real-world environments. Compromises, such as being unable to conduct interviews due to the local conditions or the museum's restriction in terms of permitted sound level, suggest that certain contingencies have to be expected and advise against approaches that are over-dependent on a particular method or factor. Furthermore, the experience and the collection of a comparable data set from the pilot study conducted in a realistic setting significantly informed the practical approach of the presented study. Important aspects were the assessment of data collection methods, first impressions of audience behaviour and the detection of technical deficiencies.

In summary, we believe that the reported case study demonstrates the value of a mixed-method approach for evaluating technology-mediated public creativity. While the qualitative components of the study promoted a descriptive understanding of the audience's social and system-related interactions, the quantitative methods allowed us to examine concrete research questions such as the value of perceived control in such an interactive multi-user environment. Moreover, by emphasising the significant influence of the context on the participants' behaviour, the presented study underlines the importance of a contextual approach in order to study,

understand and evaluate new interactive experiences within their real-world environments. In addition, we believe that also curators and exhibition designers as discussed in Chap. 15 ("Curating Digital Public Art", Turnbull and Connell 2014), can benefit from such an approach. Unlike conventional methods used in museums such as visitor surveys or the use of 'isolated' measures (e.g. visitor count) without contextual references, a systematic multi-method approach allows for a much more coherent understanding of situated audience interactions. The acquired knowledge can foster and inform new ways of presenting and designing systems and environments facilitating technology-mediated public creativity.

12.6 Conclusions

In this chapter we reported on a mixed-method evaluation of a collaborative interactive music system that was conducted during a public exhibition at the Victoria and Albert Museum in London. After a short outline of our research motivations and the *Polymetros* system, we described the evaluation's rationale and the methods used. We then presented a summary of the findings and discussed how the different methods contributed to our particular research goals. In addition, we illustrated how different methods and data can mutually inform and support each other and contribute to the overall analysis and the validity of findings. By giving clear indications that the audience's interactions were considerably influenced by the context of the public exhibition, the study emphasised the need of contextual evaluation for assessing public interactive installations. By providing different vantage points on such a complex interaction scenario, we conclude that a well-considered mixed-method approach significantly contributes to a broad understanding how audiences engage with such interactive experiences while providing insights for new designs that aim to facilitate collaborative public creativity.

References

Alarcon-Diaz X, Askaroff K, Candy L, Edmonds EA, Faram J, Hobson G (2014) In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 187–208

Bengler B, Bryan-Kinns N (2013) Designing collaborative musical experiences for broad audiences. In: Proceedings of the 9th ACM conference on Creativity & Cognition, C&C '13. ACM, New York, pp 234–242

Bentley M (2013) V&A digital design drop-in events and digital design weekend 2012 visitor profiling report. Internal report, Victoria and Albert Museum, London, UK

Bilda Z (2011) Designing for audience engagement. In: Candy L, Edmonds E (eds) Interacting: art, research and the creative practitioner. Libri Publishing Ltd., Faringdon

Blomberg J, Giacomi J, Mosher A, Swenton-Wall P (1991) Ethnographic field methods and their relation to design. In: Douglas S, Namioka A (eds) Participatory design: perspectives on systems design. Lawrence Erlbaum Associates, Hillsdale, pp 123–155

Brignull H, Rogers Y (2003) Enticing people to interact with large public displays in public spaces. In: Proceedings of the IFIP international conference on human-computer interaction (INTERACT 2003). INTERACT, Zurich, pp 17–24

Bryan-Kinns N (2013) Mutual engagement and collocation with shared representations. Int J Hum Comput Stud 71(1):76–90

Bryan-Kinns N (2014) Mutual engagement in digitally mediated public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 123–138

Bryan-Kinns N, Hamilton F (2009) Identifying mutual engagement. Behav Inf Technol 31(2):101–125

Csikszentmihalyi M (1975) Beyond boredom and anxiety: experiencing flow in work and play. Jossey-Bass, San Francisco

Csikszentmihalyi M (1990) Flow: the psychology of optimal experience. Harper & Row, New York

Csikszentmihalyi M (1996) Creativity: flow and the psychology of discovery and invention. Harper Perennial, New York

Ghani J (1995) Flow in human-computer interactions: test of a model. In: Carey J (ed) Human factors in information systems: emerging theoretical bases. Ablex Publishing Corp, Norwood, pp 291–311

Ghani JA, Deshpade SP (1994) Task characteristics and the experience of optimal flow in human-computer interaction. J Psychol 128(4):381–391

Heath C, vom Lehn D (2008) Configuring 'interactivity': enhancing engagement in science centres and museums. Soc Stud Sci 38:63–91

Heath C, Luff P, vom Lehn D, Hindmarsh J, Cleverly J (2002) Crafting participation: designing ecologies, configuring experience. Vis Commun 1:9–33

Hornecker E, Stifter M (2006) Learning from interactive museum installations about interaction design for public settings. In: Proceedings of the 18th Australia conference on computer- human interaction: design: activities, artefacts and environments, OZCHI '06, ACM, New York, pp 135–142

Ijsselsteijn W, Poels K, de Kort Y (2008) The game experience questionnaire: development of a self-report measure to assess player experiences of digital games. FUGA (the fun of gaming) deliverable d3.3. Tech. rep., TU Eindhoven, Eindhoven

Mackay WE, Fayard A (1997) HCI, natural science and design: a framework for triangulation across disciplines. In: Proceedings of the 2nd conference on designing interactive systems: processes, practices, methods, and techniques, DIS '97, ACM, New York, pp 223–234

Poels K, de Kort Y, Ijsselsteijn W (2008) Game experience questionnaire (English version). Tech. rep., TU Eindhoven, Eindhoven

Reilly D, Chevalier F, Freeman D (2014) Blending art events and HCI research. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 152–168

Sheridan J, Bryan-Kinns N (2008) Designing for performative tangible interaction. Int J Arts Technol 1(3–4):288–308

Turnbull D, Connell M (2014) Curating digital public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 221–241

vom Lehn D, Heath C, Hindmarsh J (2001) Exhibiting interaction: conduct and collaboration in museums and galleries. Symbolic Interact 24:189–216

Chapter 13
Evaluation in Public Art: The Light Logic Exhibition

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Abstract This chapter is concerned with evaluation in public art, drawing on a study of *Light Logic*, an exhibition of drawings, paintings and interactive digital works, conducted by Site Gallery, Sheffield in association with UK and Australian researchers. Evaluating public art requires methods that suit the needs of practitioners undertaking novel types of art projects. The practitioners involved are curators, artists and gallery personnel with responsibility for different aspects of the complex business of creating and installing an interactive gallery show. The chapter describes the evaluation study, including the planning and preparation that was undertaken by the gallery staff and the researchers, the information gathering methods, as well as reports on the results from a number of points of view. In particular, advice is drawn from the study that can inform further evaluation exercises in public galleries.

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13.1 Evaluation in Public Art and Interactive Art

There is an increasing drive towards finding more systematic ways of embedding evaluation into institutional art programs and funded projects. Traditionally, evaluation has been associated with measuring impact often through simple quantitative outcomes such as footfall and visitor satisfaction indexes. Public policy and institutional approaches to evaluation have predominated and, until recently, there has been less attention to the role evaluation can play in the creative process of the artists themselves. The public art think tank, IXIA, funded by the Arts Council of England (2013), was set up to promote and influence the development of art policies and strategies. In 2004, it commissioned OPENspace to carry out research into ways of evaluating public art (IXIA 2013) and produced a guide to evaluation that is useful for scoping the main issues that organizations and individuals need to take on board when contemplating evaluation. However, there is a considerable gap between advice and actual practice: practice requires methods and methods need to be learnt and tested. Thus whilst the IXIA initiative is important and welcome, it forms only one aspect of the evaluation requirements for public art.

An important dimension of evaluation is the need for advice and methods that address the specific needs of practitioners undertaking novel types of art projects and exhibitions. This is especially so in the digital interactive art field where practitioners are often working in collaboration with academic researchers whose frame of reference for evaluation may arise from different value sets and concerns (Edmonds 2011). The work may also involve risks that lead to dead ends, or outright failure to achieve the initial aims, and it is only through adopting an evaluation strategy that these kinds of experiences can be turned into positive learning. As the Wellcome Trust advice to grant applicants indicates, it is important to anticipate the possibility of failure when striving for innovation and thereby to learn from it:

> It is important that people are honest when evaluating their projects. The Trust wishes to fund innovative projects and in doing so some projects will not be as successful as others. If projects have not been as successful as hoped the reasons why are valuable for future learning (Wellcome Trust 2007, p. 1).

In the study we report in this chapter, the practitioners involved are curators, artists and gallery personnel with responsibility for different aspects of the complex business of creating and installing an interactive gallery show.

13.1.1 Digital Art Evaluation Survey

In order to establish a better understanding of the current situation with regard to the role of evaluation in public art, we carried out a survey of existing practices and the methods and documentation available to practitioners and institutions. Information was sought from museums and galleries, as well as artists' collectives and hubs with

experience in interactive digital art.[1] The survey was conducted via phone calls and email, asking the following questions:

- have you used evaluation in interactive digital art exhibitions?
- if so, which tools have you used to collect feedback?
- how do you use the collected data?

A range of methods for gathering information was identified of which the questionnaire survey format is the most common. The questionnaires help to provide feedback for the curator and the artist to measure success in terms of audience attendance and general attitudes: for example the company, Threshold Studios uses questionnaires, social media and reviews such as the ones made by students in the blog of their 2011 Frequency Festival. This information was used to evaluate audience responses to the work and to share some of this with the artists informally (Diaz 2013).

It is important to distinguish between evaluation that functions mainly for institutional and policy purposes and that which functions for individual artists and groups. We noted a difference between what institutions require from evaluation and what artists do; for the latter, the emphasis is on collecting data about specific aspects of the work in order to inform practice of the formative evaluation type as discussed in Chap. 3 ("Evaluation and Experience in Art", Candy 2014). This varies according to the complexity and goals of the artwork, the exhibition, and the role of the audience. Some works use immediate feed-back from the audience informing their work directly, such as in the work, *Audience*, created by rAndom International and Chris O'Shea, exhibited in the Victoria and Albert Museum's 'Decode' exhibition (2009). Other works involve the audiences as participants in research processes, where they become co-creators of interactive artwork. In *Day of the Figurines* by the Blast Theory artists' group, audiences are involved as performers of an experimental work crossing boundaries between the physical space of the gallery, the public street space, and the virtual space. The Blast Theory collective, whose works are hybrid forms of participatory interactive digital art, have used complex ways to evaluate audience experience: for instance, to evaluate *Day of the Figurines* they carried out a public test over 24 days, the duration of the artwork. This involved testing interfaces, running trials of varied types of content, exploring narrative, critiquing the semiotics within the work and tracking the routes through the work in chronological order. Ethnographers from the Mixed Reality Lab, University of Nottingham, worked on the evaluation of this process that informed the project's development (Blast Theory 2013). The artists claimed that this artwork shed light on several contemporary issues of HCI, as their goal was to understand how players interweave the experience of playing the game with patterns of their daily lives. Feedback, mixed with an analysis of log files of messages sent to and from the game, indicated to them: "that the majority of players exhibit an episodic style of play, sometimes playing

[1] Hubs: B3, Thresholdstudios, Axis online; Galleries: Impressions Gallery, Phoenix Arts, Somerset Film and Media, Nottingham Media Arts (Broadway), Berwisckfilm arts festival, Lighthouse Brighton, FACT Liverpool, Watershed Bristol, Furtherfield Gallery and the Tate Modern London.

intensively and sometimes not playing at all for several days before returning again" (Adams et al. 2008, p. 220).

Mixed methods for evaluation were needed to explore "when and where people prefer to engage with a mobile experience…to explore how people experience and engage in a narrative that is delivered and constructed through text messaging"; there were also technological issues such as the exploration of "new techniques for making maximum use of the limited bandwidth of each text message by aggregating information about several events into a single SMS message" (Adams et al. 2008, p. 221).

Other evaluation methods were used to support interactive participatory artworks. This type of evaluation fits into the category known as 'formative', where the aim is to explore new ideas, generate on-the-fly understandings and develop the works as a result of that process. Theatre Sandbox, a national scheme for theatre makers to research and develop experimental pieces of performance that use pervasive media technologies, devised and delivered by iShed in Bristol, adopts a formative approach to evaluation by seeking to understand the value of this scheme as a developmental process. The evaluation explored the impact of the scheme on innovation in artistic practice, interdisciplinary collaborative working and the integration of digital technology and live theatre. It focused on the process (rather than on individual performances) and used a mixture of qualitative and quantitative methods. Qualitative methods included semi-structured interviews with Theatre Sandbox participants such as artists, host venues, iShed and advisory group members; documentary analysis of Theatre Sandbox Grants for the Arts proposal, applications to the scheme, selection interview notes, websites, blogs, Twitter feeds, videos and online workspaces; observation of three salon workshops; test performances, and Theatre Sandbox showcase. Quantitative methods included: analysis of iShed's evaluation and monitoring forms completed by participants in the five introductory workshops, and a follow up online survey of workshop participants six months later (Warburton 2010).

Computer-based questionnaires were trialled by Sophy Smith and Mario Gongora who recognised the potential of such methods for providing an evaluative tool for arts organisations and this approach was trialled at the Phoenix Digital Media Centre, Leicester. The aim was to obtain feedback about audience reaction to exhibitions and their preliminary judgement was that the system did have potential. This approach was then used by Ximena Alarcón to measure visitors' engagement when listening to her sound exhibition *Migratory Dreams*; here, experimental evaluation was used to understand the experience of listeners who shared the experience of migration, focusing on evaluating connectivity rather than interactivity. For the artist, using this questionnaire helped her to imagine how, in the future, this evaluation could become the catalyst of audience's narratives, helping the audience to reflect on the experience creatively, poetically and collectively. It also helped the artist find collective narratives that bring traces of the connections established in the virtual network of dreams.

A number of conclusions from these experiences have been identified. For institutions, evaluation focuses on general feedback from the audience as a measure of the success of the exhibition. For artists, evaluation supports different aspects of their creation and research and is inter-disciplinary and experimental. An interesting finding is the emphasis on mobile phones, as a technology that expands the museum experience, involves audiences as co-creators of content (Theatre Sand-box), and

acts as performers in hybrid artworks (*Day of Figurines*). Also, sociological issues regarding the use of mobile phones are being evaluated through artworks, making it an interesting case of evaluation influencing artwork. On the other hand, evaluation tools that have been designed for other purposes, when used by an artist, acquire different connotations, and stimulate reflection about the purpose of evaluation and the creative use of collected data. Using social media has been shown to stimulate the exploration of technological aspects of the art practice. The evaluation experiences that have been identified have involved audiences in different roles (e.g. participants/co-creators/performers), expanded the reach of the museum/gallery space, and with it, explored the innovative use of technology.

The survey of evaluation experience discussed above contributes to establishing an evaluation framework that involves institutional concerns, such as engaging audiences in artworks, and artists' intentions for the interactive artworks, understood as 'art systems', and the extensions that new communication technologies offer, either as part of the artwork or as supporting devices for evaluation.

13.1.2 Digital Art Evaluation

Evaluation involves a variety of methods and many layers of richness and complexity in aims, motivations and scope. When galleries and museums conduct evaluation, typically it is done through survey questionnaires: for these organisations success relies on measuring attendance, recording media presence and attention, gaining national/international awards, and meeting project goals and deadlines. There is some attention to surveying audience attitudes but this is normally at the level of satisfaction or dissatisfaction ratings. Because the primary purpose is to measure impact and thereby justify funding, there is not much room for the finer points of audience response or indeed, practitioner learning.

The study discussed below arose from a requirement by the Arts Council of England funding body to provide an evaluation of the exhibition it had supported. However, the modus operandi and the involvement of the curatorial and gallery team went further than the artist's purpose. The procedures and methods that were designed, trialled and tested have contributed to the particular evaluation framework adopted that includes curatorial design, audience engagement, artists' intentions and the impact of bringing an evaluation orientation into public art practices.

13.2 The Light Logic Evaluation Study

The *Light Logic* Exhibition evaluation study was carried out at Site Gallery, Sheffield (Site Gallery 2012). It was part funded by the Arts Council of England (ACE). The main aim was to gather information about audience response to the artworks and installations. The objectives were to:

- To evaluate the curatorial design of the *Light Logic* exhibition
- To evaluate the audience experience of the artworks and installations

Fig. 13.1 The Light Logic exhibition (Photograph Linda Candy)

- To develop a framework for gallery and museum staff to facilitate the embedding of evaluation into curatorial practice (Fig. 13.1).

In this chapter, we discuss the planning and preparation that was undertaken by the gallery staff and the researchers, followed by an overview of the findings that emerged from the data gathered. The work was first described briefly by Candy et al. (2013).

13.2.1 Preparation and Learning by Exhibition Team

Investigating and evaluating art requires a research process that draws upon the experience of artists, curators and audiences. This section describes the way a team of curators, artists and researchers planned, trialled and carried out an evaluation study.

The first step was to agree a set of procedures to be followed by everyone involved according to their individual briefs in order that requirements for human effort, resources and equipment could be anticipated. The procedures were as follows:

1. Planning the Study: the initial planning phase involved identifying the preparation necessary prior to the gathering of data and its analysis.
2. Identify what was to be studied: this involved deciding which artworks, documentation materials and the gallery spaces were to be included in order to guide the process of gathering data from participants.

3. Determine participant profile: the range of profile types to be included in the study included age range, a balanced gender ratio and digital art experience level. The goal was to have participants who were reasonably representative of the typical attendees of the gallery.
4. Agree participant recruitment method: the methods included, for example, identifying participants from known 'faces' and putting a notice in the lobby and on the website asking for people to sign up.
5. Determine actions for ethics compliance: all participants were invited to give written consent to the gathering of data including specific agreement to being video recorded. A statement regarding the anonymity of the data collected was included.
6. Conduct Prior Trials to test logistics, methods and equipment: all members of the evaluation team prepared for the actual event by trial runs of the procedures and methods. This involved exercises during which each researcher played the participant visitor and observer at different times and the outcomes were then evaluated. Different trail scenarios were designed and tested. The team documented the experiences and met to compare notes and produce a 'snag list' for future sessions and the benefit of team members not present.

The gallery team who carried out the video observations and the follow on interview were mainly new to this kind of activity although one member had some prior experience of research in the UK's Creative Partnerships programme (Creative Partnership 2013). The experience proved to be both stimulating and challenging in respect of time and energy.

13.2.2 Gathering and Analysing Audience Information

The *Light Logic* Exhibition included paintings, drawings, time based work and interactive art. Participants were video recorded at a distance whilst they freely explored the exhibition. This was followed by a semi-structured interview, based on a set of pre-determined questions. Video cued recall was also used to remind the subjects of what they had just seen and done.

There were four main areas of focus that were represented in different areas of the gallery space as follows:

- Documentation: the artist's development through time
- The Art: the relationship between digital works, prints and paintings
- Interactive Installation: the *Shaping Space* light sculpture
- Interactive Artwork: *ColourNet* a program for influencing a *Shaping Form* artwork (Fig. 13.2)

The study included a range of aspects of the art and its exhibition including the audience experience and the way it was influenced by being involved in research. It included the curatorial and artist perspective in the kinds of issues being explored.

Fig. 13.2 The Light Logic exhibition, documentation (Photograph Linda Candy)

It used observation by video and person in combination with interviews for close attention given to individual responses. The information gathered also included documented reflections written by the gallery researchers that focused upon the experiences of learning new processes and acquiring new skills in evaluation methods. All members of the evaluation team were prepared for the study through trial runs of the procedures and methods. This involved conducting trial exercises during which each researcher played the participant visitor and observer at different times; the outcomes were then evaluated and the processes subsequently refined (Fig. 13.3).

Twenty-five participants were recruited by gallery notices and from regular visitors on basis of age range and gender, in order to have as diverse a range of participants that could, in a certain sense, be typical of a gallery visiting public. Inevitably, there were more people involved in creative works of some kind than, for example, office or service workers, so they cannot be considered to be fully representative of the public at large. All participants were asked to give written consent to the gathering of data about their activities in the study environment including specific agreement to being video recorded. A statement regarding the anonymity of the data collected was also provided.

In a semi-structured interview with each participant, a pre formulated set of questions was used together with video footage taken during their visit. Video cued recall was used to remind the subjects of what they had just seen and done in a particular area of the exhibition, *Shaping Space*. Whilst video footage of the wider participant experience could be used for analysis of travel through the exhibition, time spent looking at exhibits and so forth, the reasons behind using video-cued recall for this particular artwork was due to the artists interest in the particularities of interaction between audiences and a new interactive/generative artwork.

The questions sought to elicit audience viewpoints, which responded to particular areas of concern identified by the curatorial team and the artist. The questions were developed as a result of deep conversations between the artist, curatorial and research team, in which areas of specific interest to the teams were highlighted. From this, a

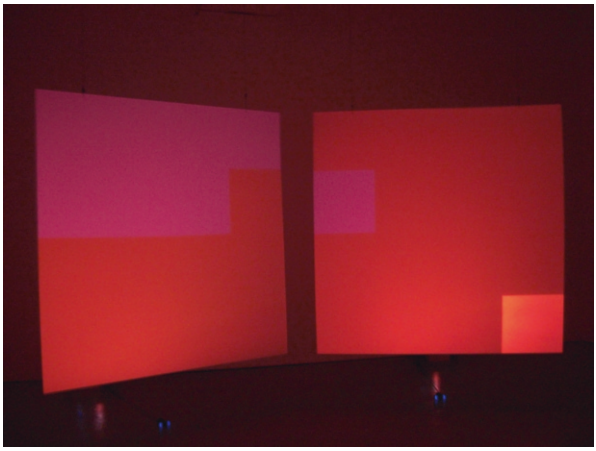

Fig. 13.3 The Light Logic exhibition, *Shaping Space* (Photograph Linda Candy)

set of questions was agreed which responded to key areas that researchers wished to find out more about. Each set of questions was grouped into a particular area of concern (for example, The Artwork, Documentation, etc). Following completion of this information gathering stage, the interviews were transcribed by two researchers and made anonymous using the references 'Participant 1, Participant 2', and so forth. Each researcher worked on around half the recordings each (that is, one research worked on the recordings of Participant 1–12, the other, Participant 13–25). These transcriptions were then exchanged, with the researchers tasked to identify key words. This afforded researchers to read the transcribed interviews with fresh eyes: key words were identified independently, and following this, the two separate sets were brought together to enable common observations/words to be identified. In effect this approach enabled audience feedback to be concentrated into key words/phrases, and in so doing provided a set of data that could be used in further analysis. The audio and video data has provided a rich source of information about the responses and experiences of the participants (Fig. 13.4).

The research team explored the ways in which the research aims might be achieved in practice. This included becoming familiar with the technologies of data capture, run-throughs of the actual processes of sourcing, recording and interviewing participants and reflection on insights gained to inform next steps. Trialling the practices of data gathering helped to hone the process towards a more practical and accessible experience for researchers and participants.

Simple adjustments to interview approaches were made, such as the order in which questions were asked, and re-phrasing certain questions to make the dialogue more conversational. Technical considerations included working out which forms of data capture were most effective, structuring the experience and the timing of various elements to enable data transfer from the public space of the gallery to the private space of the interview room, and so forth. This action research based approach facilitated an active and reflective process of progressive problem solving throughout the trialling.

Fig. 13.4 The Light Logic exhibition, *ColourNet* (Photograph Ernest Edmonds)

Through their experiences and role play scenarios, each team member found a natural fit within the project, whilst at the same time becoming familiar with the key roles required, so that each could effectively cover another team member if necessary. This supported effective knowledge exchange across the team and additionally, enabled very positive relationships to grow, bringing real energy and dynamism to the process. Working together effectively and following the rigor of the research process made a significant contribution to the quality of the project outcomes, and enabled theoretical perspectives to find practical applications that could be used in other scenarios. The richness of the data collected came about as a result of the relationships and understandings developed by the research team through trialling. This also improved the confidence of the research team and their understanding of their role as the human interface between audience and artwork. Their ability to put interviewees at ease, and sensitivity to participants in making the process as welcoming, informal and relaxed as possible, impacted on the quality and richness of their findings.

Two gallery staff ran each individual evaluation session. This required a time commitment of between 1 and 1½h for the roving camera operator/interviewer and 45 min for the second camera operator, and included uploading the video to a computer for the playback. It became clear that if the Site Gallery team was to try and embed the evaluation process into every exhibition, the method would need to be refined so that it was less labour intensive.

The recording equipment used was not hidden from participants and it would be interesting to consider the benefits of hidden cameras in order to increase their comfort level. The placement of cameras themselves is a fascinating aspect of the process. Selecting the viewing angles, from tracking the physical steps taken using the roving camera to capturing movements in the *Shaping Space* room was itself quite a difficult process, which required testing and revision.

13.3 Study Findings

From the data we identified four categories of findings:

1. Curatorial design
2. Audience experience
3. Artist evaluation
4. Observer effect

13.3.1 Curatorial Design

Most participants mentioned the following aspects of the design of the exhibition:

- the importance of an open airy and naturally lit space
- the value of digital and painted forms juxtaposed in an historical way
- archival material for what it revealed about the artist's way of working.

The documentation archive consisted of the artist's working documents arranged by the curator to reveal a certain narrative. There was a timeline on a wall at the entrance to the exhibition that placed the work in relation to other developments from the 1960s onwards, which many participants commented on as being very helpful. One or two people wanted more 'explanation' but for this kind of work it was a surprisingly small number. The general attitude seemed to be, 'I want to look and judge for myself first'.

There was an order implicit in the design of the exhibition spaces. The main art room was followed by a documentation room and then hidden behind a curtain was a dark interactive space. Only one person opted to turn right into the documentation room before going into the main open art space. Naturally, all participants are guided by personal motivations when entering the exhibition space and this determines their attitude towards the work. For instance, a painter will inevitably view the work informed by a painterly perspective. Similarly, various aesthetic and personal concerns may be reflected in the responses of, say, a filmmaker, music composer, computer programmer and so forth. Their own grounding in their specialism compliments their viewing, increasing or lessening their personal responses to different aspects of the exhibition. Two of the participants mentioned the experience of being 'connected' to the work and this suggests that through this form of evaluation, access is made available to the different levels of experience that the whole exhibition offers. For example, it is noticeable that *Shaping Space* in particular, created an impression on some participants that went further than simply looking and thinking. This suggests that Shaping Space engaged audiences in a more affective register, highlighting that this work has a particular quality that can elicit more emotional responses.

13.3.1.1 Design

A majority of participants noticed the movement of the exhibition through historical time with technology and appreciated the different technologies involved. Some of them linked these to technological games or platforms. A majority noticed the logic and organisation of the exhibition and appreciated the movement between the different media and aesthetics. For example, a respondent thought that the show was set up "to allow the audience to make relationships" and that "different qualities of execution bring depth of narrative between relationships". Although there was an intended logical organisation to the show some thought that the exhibition was "open and free" with "no overriding theme evident". A majority of participants found the space very open and easy to move through, a "space to speculate". This fact allowed them to see the contrasts in the work, particularly related to the media (print, old computers and new technology). By contrast, one referred to the space between the artworks as a "wasted space", with the overall impression that the curatorial design made the exhibition space cold and uninviting.

13.3.1.2 Documentation

A majority of participants thought that the documentation was helpful and needed. In particular, the sketches with visuals were considered very attractive and helpful and a number of people thought it was good to see the process of the artist in an historical time line. For many of the participants, the sense of time offered by the documentation helped them to understand the work and see behind the scenes. The documentation room was described as being like a 'time machine' by one of the participants, " [it] takes the viewer back to their own memories". A couple of participants found links with the artist Sol LeWitt's works and also with Lichtenstein.

Some of them thought that the documentation room was akin to a museum exhibition style. The amount of detailed information was perceived as rigorous research, giving importance to the tools with which the work was made, the context and the intellectual development of the artist. The observation of mathematical themes by some respondents, and ideas that this could lead to constraint, led one participant to comment that this aspect itself "leads to freedom" and that the documentation "brings richness…and illuminates the work". Another saw a relationship between the documentation and the artworks as revealing a series of "incremental experiments", made by the artist over time. A minority thought the documentation was not helpful, or that it was hard to read. One suggested he would have preferred to have the documentation next to the art works, as in a museum, pointing up the differences in expectation between those used to experiencing artworks in gallery spaces and those used to experiencing artworks in museum space This gives us clues that the ways in which persons 'read' and experience artworks can be strongly influenced by the accompanying texts/information.

13.3.1.3 Context

Half of the participants questioned the intention of the artist towards the audience, particularly an audience not familiar with generative art. For students and academics it seemed clear that the intention was related to showing methods and the development of the work throughout a historical period of computer art. For non-academics and non-students it seemed difficult to understand the context of the work. However, a majority noticed the chronology involved in the exhibition because of the technology used, aesthetics, and the time line in the documentation. In this way, the artwork and its historical progression was contextualised. This reveals differences in the ways in which artworks are approached, analysed and understood by those involved directly with the arts and artistic practice, and those who are not.

13.3.1.4 Physical Environment

The experience with the different media and its evolution was interesting to the majority of participants. This allowed different options of exploration for the viewers. Some of them highlighted how interesting it was to see the exploration of the same idea through different media, even if the approach to the exhibition was perceived as "conventional". The mix of media employed enabled the viewer to establish different relationships with different materials. An interesting thought, by one of the participants, was about the time line of the works, as the respondent questions "which came first?" relating to the screen works and the printed works.

13.3.1.5 Technical Content

Technically, the presence of old and new media in an historical progression was highlighted by most of the participants, and this aided the perception and understanding of artist's intention with the show. The majority noticed the progression of the work parallel to the progression of technology. However, some of them speculated on the distance that technology could create between the artist and the work (and in turn, the audience), the possibility of different options to display small interactive pieces, and the impact created by the perfection of the digital versus the imperfections of the print and painted work.

13.3.2 Audience Experience

Academics, artists, and people motivated by painting or digital work appeared to enjoy the work more. It seemed that the display elicited different kinds of focus. Some members of the audience came to see the work with expectations (e.g. artistic), whilst others came without any other expectation than a show in a gallery. Most of

the study participants appreciated the exhibition as a learning experience and commented on the rigour of the work, the documentation and the relationship between art, technology and mathematics. Half of them were not drawn to the aesthetic aspects of the work, whilst the other half, noticeably specialists in art of one form or another, described aspects of the paintings such as the graphic nature, the colours, the experience with works such as *Shaping Space*, which for one of them is almost a spiritual experience, and for other a "womb space". Some were interested in computing and mathematical work, whilst others focussed on the colours of the paintings. One expressed a wish that the work would stand without need of explanation or interpretation: as a researcher commented, he "seems to resist the notion of understanding the artist's intention although keeps referring to it".

Referring specifically to the artwork, whilst some of the participants found the exhibition not easy to understand with respect to themes and time in the development of the works, others referred to it as "sophisticated" work, particularly when the participants were familiar with generative art. One respondent saw it as "incremental experiments" that "evolve through continual evaluation and attention". Another referred to the different uses of colour across individual artworks, and the ways in which different colour combinations or palettes communicated relationships between simplicity and sophistication.

Most of the participants refer to details such as the perception of colour and the relationship between painting and digital work. Two of the participants relate this work to Mark Rothko's paintings, describing it as "electronic Rothko", another related it to Marcel Duchamp. For some the colour relationships evoked childhood memories of drawing patterns.

Some of the participants questioned the expressiveness of the art, referring to it as measured and "too mathematical", and with no emotion, also in opposition to an "organic process", whilst for others, this characteristic in the work was understood as simple and effective, with "neatness and order" but with a "human touch". By contrast, this neatness was described as "shabby" by one respondent, apparently referring to a particular work (a painting), whose 'finishing' he appeared to find at odds with its content This highlights the differences in aesthetic expectation between hand-made and computer generated artworks and the uncomfortable space an artist's work in paint occupies when creative concerns are transferred to digital media.

13.3.2.1 *Shaping Space*

The interactive installation, *Shaping Space*, projected onto screens hanging from the ceiling in space and housed in a separate, darkened room, elicited a variety of responses. Some reported feelings such as being scared, and not relaxed, also claustrophobia. Others said they felt disengaged for different reasons, such as prior expectations of interactivity (e.g. expecting immediacy) over the time spent with the work, missing information about the space, or because the intention of the artist with the piece was perceived as not clear. By contrast, a number of people said that they enjoyed the colours and perceptual vibrations. Others mentioned that this work

was remarkable within the whole exhibition, with one respondent commenting that she saw it as "an important work". *Shaping Space* provoked more curiosity than other works, and many thought it helped to bring a different perspective to the other artworks; overall it seemed to help in the understanding of the artist's progression. There were highly positive responses such as engagement with the colours and the experience of it as a "womb space", "simple and immersive", and "peaceful". For some it was the culmination of the exhibition. One of the participants was profoundly affected finding it "poetic – spiritual", and a wonderful space, that was regarded as a unique experience. It was also felt to be calming and absorbing, and having its own harmony.

A number of participants investigated the technical workings of the piece, and disappeared out of shot on the filmed recording. These participants interacted with the work in an unanticipated manner, wishing to decipher the setup rather than accepting the work as presented. Separately, participants mentioned that questions arose from the work such as: is it a computer game? Does it have a hidden message? One participant expressed an expectation that the room would be showing 'artist's film' ("like in a museum"), and his disappointment that it wasn't.

13.3.2.2 *ColourNet*

The external installation, *ColourNet*, went unnoticed by many of the participants. When noticed, it seems it did not lead to much engagement. The reasons for this were related first, to the need to have a 'smart phone', and second, the assumption that the control panel on the iPad positioned in the foyer was related to other functions within the space. Participants did not recognise the panel as being linked with an artwork, and had no idea that it was for interacting with an artwork viewable from the street after dark. Thus, there was an unsurprising confusion between the normal expectation of iPad use and that of a controller for an interactive artwork. The space where the external installation was sited was a considerable obstacle: because it was sited on the periphery of the exhibition, it was not perceived as being part of the exhibition, but part of another gallery function. Having been informed of its existence, one respondent sought it out and at first, was excited about using it. However, with time experiencing it, he began to wonder if it was a purely technological experimentation, and was confused about the artist's intention with the piece. Once discovered, another respondent said that he was interested in the ideas behind the work, and that the "opportunity to interact and control was wonderful". A respondent with previous experience in the use of QR codes was immediately engaged with the work, suggesting it brought more ideas into his frame of experience.

One surprising result of the study as a whole is the polarization of viewers' responses on different aspects of the exhibition. For example, some people disliked the interactive element but others liked it very much. Perhaps, one of the results is for Site Gallery to accept that diversity is a normal aspect of the visiting public and that this diversity should be reflected in what they offer. From the gallery's perspective, the evaluation results will inform future exhibition layouts and design and also, the way that information is provided to audiences.

Focussing upon how visitors navigate the gallery spaces in relation to the works installed, gallery staff can better anticipate the triggers and dynamics of a particular exhibition that lead to popular approaches to navigating spaces. In hindsight, with the benefit of the evaluation, it can be seen that the audience needed more information about *ColourNet*, one issue being that it was only viewable at night when the gallery was closed and when a passer by would not have realised they could interact with the piece. It might also have been better to make the archive room the identified first point of call, as it really gave viewers a perspective on the exhibition as a whole. Finally, it might have been more helpful to stress the term 'generative' in the gallery literature as it became apparent that many viewers were expecting a more immediate interactive response from the artwork. Managing expectations can now be seen to be a significant part of the gallery's task.

13.3.3 Artist Evaluation

Here we focus on the artist's interpretation of the data as evidence of audience response to the artwork. In this case, the artist drew out some interesting observations about audience response to the *Shaping Space* work. In particular, he observed a difference between the analytic versus affective responses.

The *Shaping Space* interactive work, consisted of two screens hung in space with back projection of the images and two cameras capturing motion that was fed into the program and influenced the colour range and changes in display elements. There was a distinction between audience response to the interactivity elements and experience of the whole exhibition itself. In a certain sense, the comments about interactivity arose from an attempt to analyze it. There is a clear contrast between the 'analytic' ones that denote thinking about the interactivity itself rather than being immersed in it, and the 'affective' descriptors denoting emotional and sensory responses. This suggests that a focus on the quality of interactivity by itself can be misleading especially where the audience is puzzled having had no prior experience of it. On the other hand, from the artists' perspective this puzzlement may be a very positive element that can be exploited in some way. By contrast the felt experience of an interactive artwork or installation can work in different dimensions as the widely contrasting responses to the work indicated.

The experience of an interactive artwork or installation can work in many different dimensions. See the affective responses in the right hand list in Table 13.1. The table lists a range of keywords and phrases that interviewees used in discussing their experiences when viewing and/or interacting with *Shaping Space* within the exhibition.

How does evidence of this kind provide the artist with a means of evaluating the audience response to their work? First, it is important to note that whilst artists regularly gain insights from observing audience response to their artworks in situ, a more systematic study can provide deeper levels of understanding that do not necessarily come from casual observation.

Table 13.1 Analytic and affective responses to *Shaping Space*

Analytic	Affective
Puzzled	Submerged
Not obvious it was interactive	Completely absorbed
Tried to work it out	Sacred space
Went behind the projector	Not relaxed
Not interested in moving about	Subliminal effects
Spent 10 min just watching	Hidden message?
How did the interaction work?	Anticipation
Had a sense of being in control	Calming effect
A bit frustrated	Mesmerised
Relates to other work in exhibition	Scary
A natural progression	Soaked it up-dangerous
Expected a movie	Cool
Less impact than expected	Intimate
Drawn to it less as time passed	Wow! X2
Holds attention over time	In another world
Opens up opportunities to engage	A little claustrophobic
	Escape from reality
	A womb space

Artist Comments:

The question for me is, what is it about the work that encourages these very different types of response?

Affective Experience:

My work is intended to work at this level. The reactions were encouraging and affirm the direction I am going in already. At the same time I was surprised at how strong they were.

Analytic Experience:

The comments on interactivity were unexpected and raised questions about using movement as an element in that particular context. In future work, I plan to change the response mechanisms to respond to the findings. The slow response mechanisms need to be clearer, for example. It will be an experimental process.

For the artist in this case, the affective responses to the experience of *Shaping Space* were encouraging insofar as they affirmed the direction he was aiming for. Nevertheless, he was surprised by the extent and strength of that response and felt strongly that he could build more confidently upon an affirmation of that direction. By contrast, however, the analytic responses to the interactive experience itself were unexpected and revealed a variety of questioning responses across the board about using interactive capability that relied on movement. Adults were inhibited in ways that children were not, with many refusing to stay long in the space or consciously avoiding movement altogether and leaning very still against the wall watching the work. This gave rise to some doubt about showing that particular artwork in a dedicated space that acted more like a contemplative cell, a "sacred space", reliant as the work was on physical movement. On the other hand, from the artists' perspective the audience response might turn out to be a very positive element in changing his existing assumptions about using interactivity in relation to certain kinds of artworks.

Thus, if we try to understand interactivity primarily in terms of observations of what people do (their actions, movements, outward behaviour) this can only be a partial view of the way that interactive art engages audiences. Going further into the deeper aspects of audience response, and evaluation of interactive art in general, requires enquiry methods that are directly informed by audience experience. It means that what they experience can be elicited by observation complemented by conversations. This has implications for the way we conduct evaluation in museums and galleries and in research environments.

13.3.4 Observer Effect

A minority of the participants felt self-conscious or nervous with the observation and interview experience. Some of them noticed that this might have influenced their behaviour, such as being "serious" in the interactive space, or "rushing" through the work; however for one respondent being observed caused him to stare longer at the works. On reflection, it would have been interesting to measure the time that non-participant audience members spent in the exhibition (like a 'control' group). An informal observation was that our participants looked at the show for a distinctly longer period than a regular visitor. Most subjects did not find a problem with being interviewed, and appreciated the anonymity of it.

In situations such as this, participants are strangers to the processes being employed. They may be uncertain as to what is actually going to happen: they may be self-conscious, nervous, and even anxious. Therefore, strong interpersonal skills and confidence in the self and in the process are vital for researchers engaged in this type of one to one work. Throughout the structured interview process, it was necessary for researchers to be aware of, and responsive to, the needs of participants. Researchers observed that the very fact that these were semi-structured interview scenarios, digitally recorded, appeared to put participants on their guard. As such, there was a self–imposed 'holding back' from participants. Researchers noted a very slight unease as the participant entered into the evaluation process, and recording devices were switched on.

As the questions and answers progressed throughout the sessions, the interviewee became more relaxed. This often resulted in participants losing focus, wandering off the specific question and beginning relating the telling of their experiences to different parts or aspects of the exhibition and indeed, their own life experience. A shared insight between interviewers/researchers was in how difficult it was to keep some interviewees on the specific question asked: we may conclude that the more the person warmed to their subject, and the more relaxed they became (through the environment of the questioning, their ease with the interviewer, and through increasing recall of their experience), the more connections were made relating to the whole of their experience.

Researchers observed that dialogues often developed organically, building moment upon moment as connections between the conscious and unconscious worlds of the participant worked together to become productive, and in doing so,

brought richness to the exchange. This subjective 'one to one' approach highlights the idea that each participant 'brings themselves with them' in any encounter. The sediment of their experience is inevitably latent in the persons encounter with an 'other', and is strongly operative in the participants 'sense making' in relation to their situation. This suggests that as researchers, if we present people with a series of fixed and specific questions, we may only access the conscious worlds of the participant: straightforward questions result in straightforward answers. As researchers became more experienced at asking, phrasing and 'holding the space' of the interview, their own ease with the questions and wider objectives of the process enabled them to become more discreet with the ways in which questions were asked: for example, specific questions, were increasingly delivered as 'soft' prompts. This was achieved through lowering the sound of the voice, sometimes making the question itself almost inaudible.

Through this approach, participants were guided to the next question: rather than ending one question and beginning another, this approach facilitated an ongoing and unfolding telling of experience. This enabled more flow to the conversation with researchers gently affecting the conversation rather than controlling it, allowing connections in the mind space of the participant to be made organically. This was an important insight for one particular researcher, suggesting that the ability to put the person at ease in their environment through behaviour, gesture, and intonation in a context such as this, an essentially one–off situation, is significantly important for evaluative practices in artistic contexts. Allowing the creative imagination of the interviewee to surface enables connections to be made which are considerably more expansive than basic question and answer approaches. This suggests that in learning more about the person, we may learn more about the affective potentials of the artwork under discussion, through supporting a more organic set of responses to surface.

Notably, after the informal, recorded interview had ended and the interviewee knew that she/he was no longer being recorded, there was very often a burst of energy and animated conversation between parties, almost a manner of 'wind down', which could indicate a certain level of stress for both parties during the process. Researchers agree that they found the interview process, if not stressful, then certainly, exhausting. At an average length of around an hour for each participant from arrival to departure, four complete sessions in a day proved to be the maximum the research team could effectively manage.

Researchers noted that comments offered by some participants following the close of the interview were often very insightful and colourful, exposing a more personal opinion than some participants were motivated to offer on the record. It will be interesting to explore ways in which such information can be captured more systematically than was done in this study.

13.4 Implications of Evaluation Studies for Art Galleries

This was the first time Site Gallery had used the process of interactive evaluation to assess, gather data, understand and evaluate the visitor experience in the gallery, providing further areas for understanding how people view, participate and react to

art works in their gallery environment. The project presented a unique opportunity for Site Gallery to acquire in-depth knowledge, which would inform the way they worked in the future. However, with a small, 'time-poor' team to deliver the evaluation approach, there was a real challenge to ensure that learning was embedded as they worked through the programme.

The opportunity to work with an experienced researcher as part of their team added both an additional staff member and brought confidence to the wider team. This contributed greatly to Site Gallery's organizational understanding of what could be achieved through working in this way. In working through the project, Site Gallery has developed new ways of thinking in how to observe and evaluate visitor experience in a neutral, unimposing approach.

One of the strengths of this approach to evaluation is the ways in which the process develops and builds working as a team, through supporting shared frames of reference and different perspectives and concerns to evolve. This shared approach supported innovation in organizational practice and allowed relationship building between partners, who shared the experience of thinking and doing in new ways. From this, an agreed framework was put in place that supported rigour in the research, allowing all parties to share and follow a pre-planned and tested activity that addressed shared concerns. The process improved the communication and interpersonal skills of researchers, and brought new approaches and ways of evaluating that could be shared across the wider team.

Additionally, the fact that the gallery team itself was directly involved in conducting the research brought the Site Gallery team into closer contact with their audiences, revealing the finer points of audience response and strengthening their commitment to audience development. This has led to reflections that will have an impact on future practice.

This particular approach to the evaluation study has highlighted information that would otherwise not be available by other means because of the interpersonal and probing nature of the exercise. It has brought cohesion and understanding to team members and developed relationships with audiences at an individual level, bringing knowledge of different audiences, their interests, experiences and opinions that can inform future practice.

Whilst the experience of the process has been overwhelmingly positive for the research team, this has been mediated by the labour intensive nature of the activity. There was a great deal of baseline research done to ensure research aims could be addressed in practice, and this was very time consuming in the early stages. Once the initial groundwork was in place it became a more predictable and rigorous exercise, following a pre-planned and tested activity, but carrying out the one-to-one research itself was still very time consuming, at around an hour for each participant. This was exhausting for the research team in terms of planning and timetabling to execute the research objectives, and required existing staff to be away from their regular duties.

The participant research conducted in the gallery took a lot of energy and personal resources to conduct and sustain over time, and suggests that although the outcomes are very rich, the input of time, energy and staffing hours required in conducting this

kind of evaluative approach relies heavily on the availability and quality of human and technical resources for it to be effective. Organisations and working partners must decide in what ways such a rigorous approach might be of value, importance and significance to their ongoing work. As such, rather than employing these approaches for every exhibition, it may instead be something organisations choose to use for specifically targeted activities. In doing this work, those who are directly involved came to see that there is a rich territory to explore in terms of the 'call & response' triggered in the transmission and reception of artworks and exhibitions. The ways in which this type of evaluation approach may be used by others, provides areas for further study.

13.5 Conclusions

A number of lessons were learnt from this study that could be applied to future evaluation exercises of this kind. They have been mentioned above both in Sects. 13.3 and 13.4. The pragmatic results, in summary, show that with careful planning and, possibly, with extra technical resources the data collection could be managed with one person rather than two. The process might have been improved by adding a settling down section at the beginning that was used to ensure that the participants were at ease and comfortable with the technical environment. It will be valuable to explore ways in which such equipment can be deployed more discreetly. All in all, however, the study worked well. Perhaps the important steps to stress are the planning and provisional run throughs, which served both to iron out problems and to train the research team.

The embedding of evaluation, in some form, into curatorial and artistic practice is a growing trend. The *Light Logic* exhibition case study points to the development of a framework that can be used to implement public art evaluation: in this case, the development of a guide to evaluation is being carried out by the curatorial team in collaboration with the researchers. Whilst public funding bodies need to learn about matters that influence policy, it is also necessary for both curators and artists to learn about aspects of their practice that can inform their future work and also public policy. As with some of the examples from the survey, the Light Logic evaluation is leading to reflections that will have an impact on future practice.

The type of evaluation study described here is one in which evidence about the curatorial, artistic and audience dimensions of a public art exhibition is acquired and then used to establish the value of a particular artefact or experience. This kind of approach to evaluation lends itself to the creation of shared values based on agreed evidence because it involves an exploration of situational knowledge. The gathering of information about what takes place, how audiences respond to the art exhibition and what curators and artists learn from the designing, making and reflecting process contributes to an understanding of what makes a successful or otherwise exhibition of art in the public arena. From the analysis so far, the findings promise to contribute to establishing a framework that can be applied more widely in public art evaluation.

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References

Adams M, Benford S, Giannachi G (2008) Pervasive presence: Blast Theory's day of the figurines. Documents Contemp Theatre Rev 18(2):219–257

Arts Council of England (2013) http://www.artscouncil.org.uk/selfevaluation/. Accessed 9 June 2013

Blast Theory (2013) http://blasttheory.co.uk/bt/work_day_of_figurines.html. Accessed 21 Nov 2013

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

Candy L, Edmonds E, Alarcón X, Smith S (2013) Evaluation in public art: the Light Logic exhibition. In: Proceedings of ISEA2013, University of Sydney, Sydney. http://ses.library.usyd.edu.au/handle/2123/9653. Accessed 20 Feb 2014

Creative Partnership (2013) http://www.creative-partnerships.com. Accessed 21 Nov 2013

Decode: Digital Design Sensations (2009) http://www.vam.ac.uk/microsites/decode/

Diaz K (2013) Email communication from Diaz, Online Strategy and Marketing, Threshold Studios. University of Sydney, Sydney. Accessed 20 Feb 2014

Edmonds E (2011) Interactive art. In: Candy L, Edmonds EA (eds) Interacting. Art, research and the creative practitioner. Libri Publishing, Oxfordshire, pp 18–32

IXIA (2013) Public art: a guide to evaluation. IXIA PA limited. http://ixia-info.com/research/evaluation/. Accessed 5 Mar 2014

Site Gallery Sheffield (2012) http://www.sitegallery.org/archives/4849. Accessed 21 Nov 2013

Warburton A (2010) Some kind of magic. In: An evaluation of Theatre Sandbox 2010. iShed, Water-shed, p 16

Wellcome Trust (2007) Public engagement evaluation guidelines for applicants 2007. Wellcome Trust, London

Chapter 14
Experience and Evaluation in the Collective Creation of a Public Digital Exhibition

Stephen Barrass and Ana Luisa Sanchez Laws

Abstract This chapter describes the collaborative creation of a public digital media exhibition located outdoors in the Garden of Australian Dreams at the National Museum of Australia. The exhibition was created on the ABC Pool site where people share media and work on projects. Over 100 collaborators produced in excess of 700 images, texts and sounds for the exhibition within two weeks. The rapid production of so much content raised the need to scale formative evaluation to match production. Crowd curation was undertaken through online comments, and through nominating or flagging items as favourites on the ABC Pool site. The location of the exhibition outdoors raised usability and technical issues, that included visibility, distraction, GPS accuracy and download delays. The project was analysed using the Experience and Evaluation Framework proposed in this volume. This analysis led to the identification of additional elements that further generalise the framework to projects that involve collective creativity, outdoor exhibitions, mobile media, and public digital art.

14.1 Introduction

On October 9 2010, Sander Veenhof and Mark Skwarek installed a 'guerrilla' art exhibition in the New York Museum of Modern Art (MoMA), by using augmented reality technology. MOMA holds the 'world's finest art collection' and its exhibitions are of 'unparalleled significance' (ABOUT MoMA 2014). Veenhof and Skwarek

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invited artists to upload works to their exhibition, in order to 'explore the effect of Augmented Reality (AR) on public and private spaces'. One of the effects is the possibility to circumvent curatorial authority, as the blog leading up to the exhibition makes plain …

> By the way, the MoMA is not involved in this yet. But that's not a requirement anymore anno 2010, being independent and working in augmented reality.

Visitors in the gallery could view the exhibition through the Layar Augmented Reality browser app on a mobile device (Skwarek 2010). Would the visibility of these works in the MoMA gallery confer artistic significance to them? Reports of the event mainly focus on the AR technology used to realise the exhibition, rather than the works that were uploaded and shown. The recognition of the implementation of the exhibition as the primary work of art supports the proposal that the design of socio-technological frameworks within which others can express their creativity is a new emerging role for artists and designers (Sanders 2001, pp. 5).

One of the implications of the AR exhibition is that art institutions like MoMA may need to protect the curatorial integrity of gallery spaces from digital hacking. But how can a museum prevent the use of GPS coordinates? In 2008, the Brooklyn Museum tried an alternative 'if you can't beat them, join them' approach to curation. 'Click: A Crowd Curated Exhibition', invited photographers to upload images on the theme 'The Changing Faces of Brooklyn'. Visitors to the online gallery rated aesthetics, technique, and relevance of the photos. Altogether 3,344 visitors made 410,089 evaluations. Each visitor rated their knowledge of art on a scale of {none, some, more than a little, above average, expert}, with respondents approximately equally divided in assigning themselves to these categories. The most highly rated photos were shown in a physical exhibition in the Brooklyn Museum. There was a significant overlap in the top ten photos selected by each level of evaluator. Those who rated themselves as having no knowledge of art also selected five of the top ten photographs selected by experts (Click! 2008). This result is contrary to the general observation that the winner in art competitions is not often the people's choice, (for example it has only happened twice since 1935 in the annual Archibald Prize competition run by the Art Gallery of NSW). After the exhibition the Museum organised a seminar, where curators, organisers and the public debated the proposition that non-expert crowds can evaluate artistic quality at a level comparable to individual experts (Click! 2008).

Institutions typically evaluate an exhibition based on attendance, questionnaires and surveys of the audience. Chapter 3 ("Evaluation and Experience in Art", Candy 2014, pp. 29) distinguishes this 'summative evaluation' from the 'formative evaluation', or feedback about work in progress, that tends to be of more interest to artists. Digital works provide the opportunity to include formative evaluation as interactive input to the work, which can continue to develop during an exhibition with participation from the audience. In Chap. 15 ("Curating Digital Public Art", Turnbull and Connell 2014, pp. 222), Matthew Connell describes the role of the curator in the production and maintenance of public digital art in the face of continual technological and social changes in interactive media platforms. He extends the definition of 'new

genre public art' to include 'audience engagement through technology' so that public contributions can connect digital art to a location, and develop a sense of place. This connection is evident on sites such as the Australian Broadcasting Company's (ABC) Pool, 'where people share media and collaborate on projects' (referred to hereafter as Pool). The Pool site was designed to allow writers, poets, photographers, graphic artists and filmmakers to share and remix images, text and sounds using Creative Commons to control the licensing of their material. Viewers can 'favourite' items to recommend works to others, and 'flag' items they find inappropriate or offensive. The Producers of Pool regularly invited contributions on a theme, and selected content for public broadcast on radio and television. In 2011, Pool integrated the Layar AR technology into the site, (the same technology used in the AR MoMA exhibition), so that digital content could be geo-located on a map. The *MyTribe Journeys* project explored the potential of this technology for location-based storytelling with a call for collective contributions of GPS located digital media.

Chapter 9 ("Mutual Engagement in Digitally Mediated Public Art", Bryan Kinns 2014, pp. 130) describes the collective creation of artworks within boundaries formulated by an artist. The focus of the discussion is on the collective 'micro-creation' of music made from short rhythms and tunes. He proposes that the key to evaluating collective works is to identify memes (or repeating patterns) that propagate through the socially constructed experience over time. Higher levels of engagement produce more memes that extend over longer periods. The reinforcement of memes can be considered as formative feedback about the value of particular patterns in the collective work. The visualisation of memes provides a way to compare the overall 'quality' of works, and may provide a form of summative evaluation that is an alternative to conventional expert jurying or audience surveys.

This chapter describes the collective creation of a network of location-based stories for the ABC *MyTribe Journeys* project. Over 100 artists collaborated on this project to create more than 700 images, text and sounds that are positioned by GPS co-ordinates in the Garden of Australian Dreams at the centre of the National Museum of Australia. This outdoor space contains a walkthrough map of Australian geography, culture and history conveyed by graphics, text, sculptures and landscaping. The following sections describe the framework for collective production, and the process of development of this project. The outcome is analysed through the Evaluation and Experience framework proposed in Chap. 3 ("Evaluation and Experience in Art", Candy 2014). This analysis identified additional components that can generalize the evaluation to the collective creation of location based digital artwork in an outdoor gallery.

14.2 Background

At the centre of the National Museum of Australia is an open space about the size of a cricket pitch, called the Garden of Australian Dreams. This space contains a walkthrough map of Australian geography, culture and history conveyed through

Fig. 14.1 The Garden of Australian Dreams

layers of graphics, text, sculptures and landscaping. A shallow pond borders the coastal outline of the top end of Australia, as shown in Fig. 14.1. The two main layers are a map of places and roads, and a map of aboriginal language boundaries. Other layers include maps of vegetation, soil and geology, explorer tracks, electoral boundaries, a weather map from Australia Day 1998, the Dingo-proof fence, and the Pope's line that divided the world between Portuguese and Spanish interests in the fifteenth century, and is now the West Australian border.

There are also conceptual and abstract references such as the word 'home' written in 80 different languages, plantings of oaks to represent immigration, and references to famous Australian painters and paintings (Weller 2002). This is the one part of museum where there is no explanatory text, in line with the Architect's intention to leave the space open to interpretation. However, soon after the opening of the museum, guides were introduced to answer queries about the meaning of the garden, explain the references, and tell stories sparked by various features. Geoff, who has been a guide since the opening of the museum, observed that:

> When people walk into the Garden of Australian Dreams they don't understand what it is for, but once you explain it to them it really comes to life and they spend a lot of time looking around, asking questions, and find it very interesting.

The idea for the project came in a discussion with Catherine Styles, Digital Learning Designer at the National Museum of Australia, about the potential to use

mobile media to add extra information to the museum collections. The installation of Wi-Fi in the Garden of Australian Dreams led to the idea of linking images of objects in the museum galleries to graphic and sculptural references to those objects in the Garden. For example, standing near Cooper Creek on the map in the garden would cause images and text about the Burke and Wills expedition to appear on a mobile tablet. As a result of this discussion a Curator provided a DVD of images of objects from the museum collections to seed the project.

14.3 Project

The project was an assessment item in 'Cross-media Production', a subject in the Bachelor of Media Arts at the University of Canberra. Students in this subject examine the forms, cultures and practices of cross-media or hybrid production, where producers use multiple technologies, media forms, and modes of audience interaction to deliver a single work. They consider and evaluate the relationships between media elements and participatory audiences that characterise such works, and develop a critical understanding of current practice and theory in cross-media production. They apply that understanding in collaborative teams working together to integrate networked, linear and interactive elements into prototype cross-media projects. In order to explore collaborative creativity, the size of the team was scaled up from the conventional group of four or five, to include the entire student cohort of 140 on the one project.

The direction for the project was based on the ABC *MyTribe Journeys* project that called for artists and writers to contribute personal stories and memories linked to places across Australia, using GPS located images and text that could be accessed through the Layar browser on a mobile phone or tablet. ABC Pool provided the socio-technological framework to upload and connect the stories. Each artist on Pool has a page where they are able to upload digital content such as photos, graphics, text, sounds and videos, and share this content with others, or make it publically visible. Our version of the project, called *MyTribe Journeys through the Garden of Australian Dreams*, began with the idea to link symbolic references in the garden to the objects in the galleries. The project was extended to encompass the *MyTribe Journeys* theme by including personal responses, memories and interpretations. This extension also resonated with the byline of the National Museum of Australia, which is 'where our stories live'. This work would explore the proposal that public digital art can be a way to link meaning to place, and to develop community. The physical location at the centre of the National Museum explores the relationships between curation, creative interpretation, and visitor experience. The project also provided an opportunity for the students to explore and develop new forms of location-based storytelling using Augmented Reality and digital media. Finally, the project was an experiment in collaborative creativity at the scale of 100 co-artists.

The project began with a visit the Garden of Australian dreams to find five symbols or locations that had personal significance or resonance. The points were

Fig. 14.2 Points of interest in a Garden of Australian Dreams (700 points)

photographed and uploaded to Pool, and the GPS location was marked on a Google map. The waypoints were then visible on Pool, and would popup in the Layar browser when you were close to the GPS coordinates in the garden. A distinctive icon was chosen to distinguish individual sets of waypoints, as shown in Fig. 14.2.

The next stage was to create a personal journey through the five chosen waypoints, using text, image and sound. Visitors to the space could then use the Layar browser to follow an individual journey through the garden, or view the range of responses to a particular symbol or place, such as the Chinese character for 'home', or a town like Wagga Wagga, New South Wales.

14.4 Observations

The location of 700 points of interest in the first 2 weeks of the project demonstrated the power of collective creativity at the scale of 100 participants. The points could be viewed on a Google map, and the photo documentation of each point was visible on the Pool site. In the second stage, the students added a personal element to each point, effectively doubling the amount of content. At this stage there was a formative assessment designed to guide the work-in-progress. However the need to provide feedback on so much content was a major stumbling block. This led to the idea to harness the 'Favourite' button that is used for social filtering of the even larger mass of content on Pool. The students were asked to favourite 3 works-in-progress they liked, and to use the comment field to provide feedback about what they liked about the work, as well as suggestions on how it could be improved. The peer-critique using the social filtering process built into the Pool site proved to be a scalable solution to the problem of evaluation in a large-scale creative collaboration. The exposure to each others work

could also potentially generate memes that could tie the stories together into a more coherent whole. Repeating themes included family holidays, childhood memories, stories of immigration, and favourite Australian artworks.

The exhibition was designed to be viewed on-location in the Garden of Australian Dreams through the *Layar* browser on a mobile device. The *Layar* browser has a slider that selects items in a range from 50 m to 5 km for viewing. The garden is approximately 60 m wide by 80 m long so all of the content was well within range. In theory this seemed a good thing. However, in practice it took 20–30 min to download all of this content over the Wi-Fi connection. The distance setting in *Layar* could not be set to less than 50 m to select a smaller subset of the content. As soon as another device running the *Layar* browser entered the area the download time increased, and more devices slow it down further. These usability issues dominated the user experience.

The need to address the usability led to the idea to prune the content down to just ten Journeys. Again, the social filtering mechanism on Pool provided a solution, by automatically sorting the content by number of favourites. This made it possible to curate an exhibition of the ten most favourited journeys in which the experience was not devalued by the usability effects of the Wi-Fi bandwidth constraints.

In further testing in the garden it was found that the phone screen was difficult to see and read in full sunlight. The size of the screen also affected the ability to see and read the content, with the larger size of tablets making them more usable than mobile phones.

14.5 Analysis

This section analyses the outcomes of the *MyTribe* GOAD project using the Evaluation and Experience Framework proposed by Linda Candy in this volume (Candy 2014). This Framework characterises art in terms of Participants, Experience, Outcomes and Environment. The Participants category describes 'who is involved', for example Artists, Technologists, Curators, Audience, Organisers and Funding Bodies. Experience describes 'what takes place', for example Audience Engagement, Art Practice, Curatorial Design, or System Development. Outcomes are Artworks, Installations, Exhibitions, Performances and Compositions. Environment describes 'where it happens' in the Studio, Laboratory, Museum, Gallery or Public Space. The event is then analysed in terms of Actors, Features to be Evaluated, and the Qualities or Values to be measured.

The analysis of the *MyTribe* GOAD project is shown in Table 14.1. The Actors are artists, curators, and the audience. The features to be evaluated are the skill of production and execution, the experience of the work by the audience, and the curatorial intention of the work. The qualities and values to be evaluated are the level of skill in the work, the engagement of the audience with the experience, and the response of different demographics to the work. Methods for evaluating these qualities and values could include interviews, video analysis, talk-aloud walk-throughs, and data about access to the content that is generated by interactions with the work.

Table 14.1 Framework analysis of the project

Evaluation + experience	Actors	Features to be evaluated	Qualities, values to measure
Participants	Artists	Skill	Skill level
	Audience	Experience	Engagement
	Curators	Intention	Demographic
Experience	Audience engagement	Behaviour	Curious
	Art practice	Attitudes	Knowledgeable
	Curatorial design	Interaction	
	Art system	Design	
Outcomes	Exhibition	Surprising	Immediate
		Compelling	Engaging
		Aesthetically pleasing	Purposeful
		Effective	Enhancing
			Disturbing
Environment	Museum	Physical space	Design quality
	Public Space	Lighting	Usable
		Technical facilities	Adaptable
		Resources	Effective
		Constraints	Innovative
		Support	

The collaborative participants in collective artworks may be distinguished from the artist who designed the socio-technological framework for the production, and the audience for the exhibition. If the work is designed to build culture, identity and sense of place, for example through photographs of the Faces of Brooklyn, the community is also a Participant. From the beginning of the *MyTribe GOAD* project museum staff expressed concern about the need to ensure the production quality of the content. The publically visible development of the work on Pool resulted in suggestions for improving the production quality of the work from members of the Pool community. The exhibition in the centre of the National Museum of Australia also led museum staff to caution about the cultural appropriateness of the content. Again, the visibility of work-in-progress on Pool provided a mechanism for a culturally diverse community to flag inappropriate content.

The experience of a collective project also includes the experience of co-creating the content. Features of this experience include sociability of the community, the sense of a cohesive direction, and the openness to remixing and extension. The many expressions of frustration with the interface to Pool during the development of *MyTribe GOAD* also identifies the usability of the creative framework as an important part of the experience for collaborators in collective projects. Qualities and values that could be used to evaluate these features include the spread of memes through the social construction, the amount of traffic on the collaborative platform, the number of comments providing formative feedback on work-in-progress, the number and rate of contributions, extensions to the original direction, and expressions of frustration identifying usability issues with the creative platform.

Table 14.2 Summary of proposed additional aspects to generalise the Evaluation and Experience framework

Evaluation + Experience	Actors	Features to be evaluated	Qualities, values to measure
Participants	*Collaborators*	*Production values*	*Number of collaborators*
	Community	*Cultural significance*	*Amount and quality of social interactions*
			Amount and quality of creative contributions
Experience	*Co-creation*	*Sociability*	*Memes*
		Cohesion	*Traffic*
		Openness	*Comments*
		Usability	*Contributions*
			Extensions
			Frustration
Outcomes	*Community*	*Interactions*	*Themes*
	Place	*Information*	*Constructive comments*
		Enhancement	*New information*
			Understanding
Environment	*Outdoors*	*Ergonomics*	*Handling*
	Mobile	*Usability*	*Visibility*
		Interactivity	*Audibility*
			Screen size
			GPS accuracy
			Download time
			Network latency

Additional outcomes from the project included the sense of community developed through peer reviewing and social curation of each other's contributions, and the connection to place generated by the links to the map of Australia. Features to be evaluated include the interactions between members of the community, new information about places on the map, and better understanding of the existing content in the Garden of Australian Dreams. Community interactions can be evaluated from number and quality of comments on work in progress. New information that has been generated can be evaluated from the contributed content. The enhancement of understandings of the existing content can be evaluated from audience surveys.

The environment for the exhibition was outdoors on a mobile device. Features to be evaluated include the ergonomics of the device, and the usability of the *Layar* browser interface. The qualities and values to be measured include the ease of holding and manipulating the device whilst standing and walking around, the visibility of the screen in bright sunlight, the audibility of sounds in the outdoors, the amount of screen space available to display content (which varies significantly between tablets and phones), the range and accuracy of the location sensing, and the time required to download the content.

Additional aspects of Evaluation and Experience identified through the *MyTribe GOAD* project are summarised in Table 14.2. These additions extend the Framework to include the collective creation of an outdoor exhibition designed to enhance a culturally significant place in an outdoor environment.

14.6 Conclusion

This chapter described a project in which more than 100 collaborators created a public exhibition of mobile media outdoors in the Garden of Australian Dreams at the centre of the National Museum of Australia. Staff from the museum raised concerns about ensuring the quality and appropriateness of the content. However the rapid and continual creation of hundreds of items of content overwhelmed individual attempts to monitor and curate the work. This led to the idea to crowd-source curation using social filtering widgets such as 'favourites', 'flags' and the 'comments' field to provide formative feedback on work-in-progress. This process propagated the spread of shared memes that indicate engagement in a social construction. The socio-technological framework provided by the Pool platform proved critical for the collaborative development of the project. However, usability problems with the interface caused frustration that clearly impacted the experience of creating the work.

The location of the exhibition outdoors also raised challenging issues. Usability problems included the poor visibility of the display of a mobile device in bright sunlight, environmental noise, and the risks of interacting with the device while walking on uneven surfaces close to water. Technical issues included long delays in the download of content through the wireless network, and the accuracy of GPS tracking which allowed location-based media to be placed in a 50 m radius, but not more specific locations.

In mid 2013 the ABC Pool site closed, after 5 years as a public platform where a vibrant community made up of creative, collaborative individuals and groups shared media and engaged in discussion about how public broadcasting could include online community participation (ABC Pool Website 2008). This also forced the closure of the *MyTribe* GOAD exhibition, underlining the problem of longer term maintenance of digital art built on social media platforms. These ideas and the learning from the Pool experiment continue to be developed in the ABC Open site that invites regional communities to produce and publish photos, stories, videos, and sound through the ABC (ABC Open Website 2012).

The application of the Evaluation and Experience Framework to analyse the *MyTribe GOAD* project led to the identification of additional elements that extend the framework to collective creativity, outdoor exhibitions, mobile media, and public digital art. These contributions can guide the design of the creative experience, and the identification of features and qualities to be evaluated, in future community digital art projects in outdoor environments.

References

ABC Open Website (2012) Australian Broadcasting Commission. http://open.abc.net.au. Accessed 20 Feb 2014

ABC Pool Website (2008) Australian Broadcasting Commission. http://www.abc.net.au/pool. Accessed 20 Feb 2014

Click! (2008) Brooklyn Museum. http://www.brooklynmuseum.org/exhibitions/click/comparison.php. Accessed 20 Feb 2014

Bryan Kinns N (2014) Mutual engagement in digitally mediated public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London

Skwarek M (2010) We AR in MoMA. http://www.markskwarek.com/We_AR_in_MoMA.html. Accessed 20 Feb 2014

ABOUT MoMA (2014) New York Museum of Modern Art. http://www.moma.org/about/. Accessed 20 Feb 2014

Sanders L (2001) Collective creativity, LOOP: AIGA. J Interact Des Educ (August, Number 3)

Turnbull D, Connell M (2014) Curating digital public art. In: Interactive experience in the digital age: evaluating new art practice. Springer, London

Weller R (2002) Stepping across a continent. Landsc Des 308(March):4–9

Chapter 15
Curating Digital Public Art

Deborah Turnbull and Matthew Connell

Abstract This chapter examines the practice of curating digital art in both museum and public art contexts. Extending from the *Beta_space* model of a living laboratory for audience interaction and evaluation and through a series of selected case studies, it will consider the different methodologies that creative practitioners might follow for the presentation of new interactive digital art works. Three models that are useful in reviewing the current state of curating digital public art are discussed: first, the Museum Model: exhibiting in national public museums such as the Powerhouse Museum, Sydney; second, the Government Model: government funded commissions; and third, the Independent model, exhibiting through working with an independent curator. The different strengths of each model are discussed in the authors' reflections on current methodologies in place.

15.1 Introduction

This chapter reports and reflects on how digital public art is being commissioned. Here we review three models that examine case studies regarding the act of commissioning this emerging form of art. We utilise the Powerhouse Museum Sydney's traditional collection process as the basis for determining how an institution evaluates artefacts and selects them for display. We then discuss how experimental research

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platforms, such as Beta_space that operated outside the traditional 'object collection' method for display, were important examples of platforms that diverged from the traditional approach in order to provide access to early ideas and prototypes, allowing for audience feedback and creating a more lived experience. From here we move outside the museum model and explore current examples of work funded by government commissions such as digital public sculpture, and discuss the variety of evaluative methods used to incorporate community feedback, set parameters for construction and the different ways that the life-span of an art-work can be determined through formal and informal feedback. The third model, where creative practitioners can work with independent curators, allows for more experimental approaches to assessment criteria. With a heavier reliance on expert contractors than those models already situated in the creative sphere, corporate funder, Ausgrid, provides their collaborators with a static site, a loose brief stating the type of work and quality of realisation they are looking for, and a requirement for specialist contractors and participants to fill in, and at times create, the criteria for assessment and realisation.

15.2 Digital Public Art and Evaluation

The history of public art is hotly contested, and involves political activism, social change, multiple mediums and a desire to engage the audience in art making. In 1995, Suzanne Lacy, feminist artist and writer, termed this evolving medium 'new genre public art' and defined it outside the bureaucracies that funded public sculpture. She defines it as specifically community-oriented work encapsulating mixed mediums including sound and film. The works, in her opinion, emerged as locative, in the sense of being tied to a community, an ethnicity or a practice. Lacy includes artists and the audience in her explanation, stating that perhaps even the relationship between the two may be measurable and might be representative as an artwork in its own right (Lacy 1995).

In his paper 'The Known World', Gibson discusses a rhythmic tension that artists experience when creating and then reflecting upon their own work. Artists who utilize their own practice in their research (as many do in this book) are caught between the distant, more methodological and scientific approach of evaluation and the more descriptive narrative that accompanies the lived experience of being involved with an interactive work. He calls this tension, this duality of encountering digital art, "the inside and the outside experience of things". Gibson refers to a complex knowledge that emerges, a knowing that is usually "tacit, unspoken [and] unanalysed" (Gibson 2010, p. 7).

When Matthew Connell became involved with the Creativity and Cognition Studios in establishing Beta_space, at the Powerhouse Museum, Sydney a living laboratory model that he had been experimenting via previous research relationships with became a successful model for artists and researchers to work together to evaluate interactive and digital art (Muller et al. 2006). Turnbull was the second curator with Beta_space, and in 2011, Turnbull and Connell together explored

this practice-based research approach of exhibition and reflection in regards to the museum space in their chapter *Prototyping places: the museum*. Here, they discuss the expectation that museum audiences were changing with the rise of digital technologies, and in particular, that they were becoming more active and wanting to connect with the objects on display in new ways, rather than looking at them passively in showcases (Turnbull and Connell 2011).

The Powerhouse Museum Sydney responded in many ways, one of which was to embrace the Beta_space ethos for 6 years by providing floor space and staff resources to assist with the installation, launch and evaluation of these prototype exhibitions. At times, somewhat non-traditional methods were employed, in that materials were sourced and activities occurred against the accepted grain of the traditional museum ethos. In this way, Beta_space was able to slowly influence the idea of what was acceptable in terms of exhibition objects (Turnbull and Connell 2011). This is similar to Sheridan's experience described in Chap. 16 ("Digital Arts Entrepreneurship: Evaluating Performative Interaction", Sheridan 2014) of the exploratory side of exhibiting digital art in her chapter on entrepreneurship. She often had to modify her methodologies or utilise platforms in ways her colleagues didn't immediately understand or accept. In time, however, and by example, she won them over and her curatorial approach was recognised. Perhaps most importantly, rigorous evaluation was included in each Beta_space exhibition cycle. The Beta_space evaluation criteria are situated in the *Where?* axis of Candy's Multi-dimensional Model of Creativity and Evaluation (MMCE) that is, the environment within which resources and expertise as well as physical spaces are included in the evaluative context (Candy 2012). A shorter account of this is included in the Evaluation and Interactive Experience Framework described in Chap. 3 ("Evaluation and Experience in Art", Candy 2014). In developing criteria for evaluation in terms of a pre-determined space, the final criteria were dependent on the constraints of the environment, the audience's active engagement with the prototype and their feedback to the artist-researcher.

In the Beta_space study (Turnbull and Connell 2011), we concluded that the test, in a way, became the control. In attempting to showcase new media artwork and ideas in a traditionally static, or very slow moving, museum environment *Beta_space* revealed the experimental and iterative practice behind the creation of digital public art and the crucial role that both the audience and evaluation plays in the iterative cycle. Standards were set whereby "the museum c[ould] begin to play a vital role as a laboratory for the creation of new work and new knowledge." (Turnbull and Connell 2011, pp. 79, 93)

15.3 Commissioning, Managing and Evaluating Digital Art

We identify three main models that are useful in describing the current state of curating digital public art in Australia:

1. The Museum Model
2. The Government Model
3. The Independent Model

We will detail these in turn below.

15.3.1 The Museum Model

'Determining the significance of an object' takes on a special meaning within collection-based institutions such as libraries, museums and archives. It is "a process that investigates and analyses the meanings and values of items and collections… [it] is a proven persuader [and] goes to the heart of why collections are important and why they should be supported." (Russell and Winkworth 2009, p. 2). This collections-focussed method is quite powerful in terms of assessing the importance of a collection and in shaping the social history of an area by what is included in that collection. It can be utilised across several platforms within an institution, be it for new acquisitions, funding applications, or when lobbying for online or education resources.

In museums, the Powerhouse included, the standard way for an object to appear on display is through application for collection using significance as a negotiation tool to argue its value as part of a larger exhibition or collection. This is generally a more traditional approach whereby an object is assessed by a curator in the relevant field, put to a committee meeting of conservators, registrars and facilities staff for recommendations, and then submitted to the director for final approval. However, this can take time and is the recommended method for exhibitions with longer trends and persistent ideologies. Furthermore, it is not enough for a work to be well-known or controversial for it be accepted, it must also relate to the disciplines the museum focuses on, which, in the case of the Powerhouse Museum, are science, design and technology.

15.3.1.1 The Museum Model: Alternate Approaches to Significance

With the rise of contemporary culture and the pervasiveness of the digital age, the Powerhouse Museum has responded to more immediate concerns in the cultural zeitgeist through our public programs departments. Objects representing these concerns are not always historical objects, sometimes they are designs, inventions, experiments or examples of live research. Many contemporary museums allow for these interventions and disruptions in the core collection practice through festivals, competitions and the partnering of key stakeholders in pre-packaged exhibitions.

There are many examples of this in the Powerhouse Museum's 25-year history: popular examples are the Youngblood Design Markets,[1] the Ultimo Science Festival,[2] the Australian International Design Awards[3] and the Engineering Excellence Awards.[4] In 2013, the International Symposium of Electronic Art partnered with the

[1] http://www.powerhousemuseum.com/youngblood/

[2] http://www.powerhousemuseum.com/media/?p=150

[3] http://www.powerhousemuseum.com/exhibitions/design_awards_2013.php

[4] http://www.powerhousemuseum.com/engineeringexcellence/2012/

Fig. 15.1 Powerhouse Museum's collection and display experience model. NB: *E&R* experience and reflection

Powerhouse to display interactive and bio-art exhibitions.[5] Later in 2013, the Game Masters exhibition from the Australian Centre for the Moving Image in Melbourne saw video game designers in the same light as their more traditional experience and object designers. Just prior to Game Masters, the Mini Maker Faire from MAKE made space for inventors across multiple disciplines to display their work, in either a finished or in progress state.[6]

In these ways, the Powerhouse Museum, and museums in general, have become powerful spaces for discussion and display of that nexus where art, science, design and technology incorporate research into aspects of their making and doing. An excellent and more closely related example of a similar project is the aforementioned Beta_space laboratory. Figure 15.1 represents the different ways in which museums, the Powerhouse included, accept objects on the exhibition floor, both traditionally in fixed ways, and in more modern, perhaps more temporary ways. Audiences and researchers travel between all three modes of representation experiencing and reflecting on the content as they go.

Case Studies #1 & 2: Beta_space meets the Articulated Head

As mentioned previously, Beta_space operated from 2004 to 2010 in the Power-house Museum as an interactive public art laboratory. This model of prototype exhibition space for art systems with the museum audience as an evaluative medium strengthened the existing model for University/Museum alliances within the institution (Turnbull and Connell 2011). In collaboration with the Creativity and Cognition

[5] http://www.powerhousemuseum.com/exhibitions/isea2013/

[6] http://www.powerhousemuseum.com/media/files/2013/11/MR-Maker-Faire-Sydney-FINAL.doc.pdf

Studios at the University of Technology, Sydney, 3 curators produced some 30 experimental exhibitions over 6 years. In this time, researchers affiliated with Beta_space established an evaluative framework that has been influential in the Powerhouse museum to this day. This is so much so, that it is difficult to evaluate a digital work without referencing the knowledge generated in that small space. Connell comments on its success below:

> …The beautiful thing about Beta_space, to me, is that it is a place of experimentation. We're a museum of design and this is a prototyping space; we're a museum of science and this is an experimental space, it's also a place where we invite our visitors to comment on what they see…not everybody gets to comment at great length, but some visitors get the opportunity to say what they think and maybe in new rounds of Beta_space we'll extend that capacity for comment… (Turnbull and Connell 2010)

This desire to extend the design, exhibition and evaluation strategies learned in Beta_space is made explicit in the second case study: the exhibition of Stelarc's *Articulated Head*. This exhibition developed out of both the external partnership and competition platforms of object display (see Fig. 15.1). Each year the museum mounts an engineering display in which a selection of the award winning entries are presented in collaboration with the Sydney Chapter of Engineers Australia. In 2010, the *Articulated Head Project* by the MARCS Auditory Laboratory from the University of Western Sydney, won the Bradfield Award for Engineering Excellence in the research category and was chosen to be part of the year long exhibition housed in the Success and Innovation Galleries at the Powerhouse Museum.[7]

When the Powerhouse exhibition team were developing the Engineering Excellence display for 2010, they were approached by Stelarc and his team about the possibility of continuing the research project onsite. Their aim was to have the interactions between museum visitors and the *Articulated Head* analysed and evaluated to guide further systems development. Museum staff were delighted with the approach as it was an unsolicited request to undertake a project in line with recently established strategies to re-develop some of our gallery spaces as living laboratories, the evaluative criteria of which was developed during the Beta_space project (Muller et al. 2006). A simpler way to say this is that exhibition staff were comfortable with evaluation that incorporated the audience as a direct result of the Beta_space precedent. One of the intriguing outcomes of both the Beta_space and Thinking Head projects is that due to the inter-disciplinarity and cross-collaboration of practitioners, the lines that delineated predetermined roles such as software developer, engineer, artist, performer, curator and researcher began to blur. Complexity ensued and was experimented with and negotiated, and we think, new knowledge was gained.

There exist two examples of performances in league with the *Articulated Head* that happened within these auspices of the Beta_space evaluation framework. Both Stelarc and the MARCS research group had their own evaluative processes in place in order to collate and improve the systems, most notably these interests crossed

[7] http://www.powerhousemuseum.com/engineeringexcellence/2012/exhibition.php

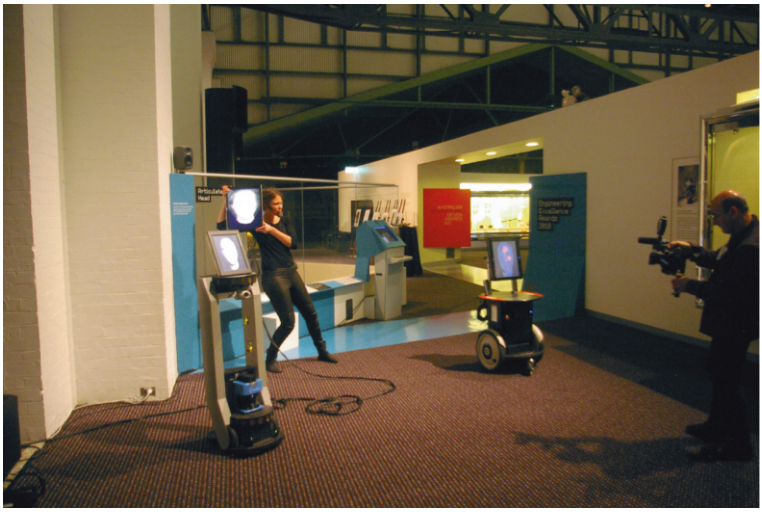

Fig. 15.2 Erin Gee and Stelarc, performing and evaluating with the Articulated Head and miscellaneous robots. *Orpheus Larynx*, 2011. Performance on Saturday 27 August 2011 in the Success and Innovation Galleries, Powerhouse Museum, Sydney (Image Courtesy of Amanda Reid, with permission from the artist Erin Gee)

over when it came to evaluating the audience's responses to both the system and the performances. In the simplest terms, the *Articulated Head* was an artificial agent attached to a robotic arm that audience members communicated with by keyboard. It was utilized in two collaborative performances where evaluation took place: one called *Orpheus Larynx* featuring roboticist and classical singer, Erin Gee, with Damith Herath and Zhengzhi Zhang (Fig. 15.2); and one that took place in both virtual and real worlds titled CLONE Second Life character Pyewacket Kazyanenko (controlled onsite by Daniel Mounsey) participated in a partly programmed and partly improvisational collaboration where avatars control automatons and artificial agents. It was during this latter performance, CLONE, that Creativity and Cognition Studio researchers evaluated audience's response to the performance by survey.

15.3.1.2 Reflections on the Museum Model

The Museum Model reveals that quite a few evaluative measures exist in terms of large scale, digital objects making their way to the museum floor for display. There is traditionally a critical, almost peer-reviewed assessment that occurs when determining the significance of an historical object for collection and exhibition. The results are collated and sent to the director for approval before moving ahead with collecting the object. Due to the amount of time it may take to make these cross-departmental assessments, this avenue is common for exhibitions with longer lead times and more static themes.

There exist simultaneous opportunities for displaying ideas with more fluid and experimental criteria. Good examples of these opportunities are the designs that come to the Powerhouse as prototypes or research queries, and as such are exhibited as part of competitions such as Engineering Excellence or festivals such as the Ultimo Science Festival. As with the *Articulated Head* from MARCS Auditory Lab, there may be another layer of evaluation that occurs, one that complies with the criteria of an external institution such as the University of Western Sydney, or as with Beta_Space, the Creativity and Cognition Studios at the University of Technology, Sydney (Bilda and Turnbull 2008). This more focused evaluation might have more to do with examining anomalies in the art/engineering systems and how the audience responds to those anomalies during the experimental acts of performance or situated play, as with *Orpheus Larynx* and CLONE. In this way, the audience is almost a part of the artwork, and the artwork cannot evolve without the audience working with the researcher to improve the systems. The artworks themselves are designed this way, as prototypes to be improved on or as research queries to be investigated. These criteria differ from the more distanced approach of historically determining the significance of an object as part of a more permanent exhibition.

The Museum Model is an outstanding example of the rhythm that Gibson refers to- a rhythm that occurs when creative researchers examine both critically and experientially their objects and ideas on display.

15.3.2 The Government Model

In this section, we use the City of Sydney Council's public art programme as an example with which to discuss the Government model for curating digital public art. The City of Sydney (CoS) offers creative practitioners the opportunity to design, pitch, evaluate, refine and present art on a large scale through its public art platform City Art, including hiring the staff or collaborating with partners.

The six main ways that works are proposed or curated are by:

1. being nominated by a Public Art Advisory Panel
2. being nominated by a competitively appointed Curator
3. being nominated by a competitively appointed consultant for Capital works and major projects
4. responding to Open Calls for Expressions of Interest
5. becoming involved through a Partnership programme where the city speaks to a larger organization on behalf of the artist's practice
6. speaking to the Council Events Liaison Unit for information on your idea/project, including information about any other grant schemes that may be applicable.[8]

[8] City of Sydney. http://www.cityartsydney.com.au/cityart/about/CommissioningNewWorks.asp

Fig. 15.3 12-step active process to the 'Responding to Open Calls for Expressions of Interest' City of Sydney Public Art application for independent creative practitioners

The first three options are predominantly influenced by who an artist knows, and whether they have produced enough successful work that a well-known curator or consultant would think to nominate them as a project takes shape. Most independent practitioners would become involved in this platform through option 4 – responding to Open Calls for Expressions of Interest. Again, a diagram (Fig. 15.3) may assist in visualising the 12-step process that applicants go through when applying to a public call through the city of Sydney.

It is interesting to note that there is space in this model for the lead creative practitioner to develop their idea with their team and make revisions prior to the lengthy application process. This first evaluation stage is self-reflective in the beginning but is then followed by a peer-review process. Second, each City Art commission for public art has a component within its development application process for public commentary called Community Comment. This usually happens during the monthly meeting at Sydney's Town Hall where concerned citizens have the right to actively support or query aspects of the project that is under consideration. Any major issues are noted and managed by the Project Officer assigned to that application.[9] This process could be seen as a formative evaluation methodology that allows for community input into aspects of a publicly funded and executed artwork. Perhaps most importantly, there does not appear to be a capacity for summative evaluation in this process. As such, the funding body seems content to release the artwork into the public sphere after addressing the initial public commentary and implementing the approved recommendations by experts to alleviate these concerns.

[9] http://www.cityofsydney.nsw.gov.au/development/development-applications/comments-and-objections

In the following section we discuss two case studies of projects that went through the City Art application process, which consisted collaborative art/technology partnerships, and were subject to both formal and informal evaluation with the public resulting in elements of the artwork being changed.

Case Study #1: Earth vs. Sky

Mr Snow and Zina Kaye are creative digital practitioners who collaborated with artist Allan Giddy on *Earth V Sky* (Kaye and Snow). This work gathers weather information from a wind turbine, transforms it into a colour selection which is then used to light up two Moreton Bay fig trees in Rozelle Bay. In interviewing Zina Kaye, the application and assessment process, or evaluation of the project, happened at several stages, both leading up to and upon completion of the installation. Firstly, there was the response to a call for public works that the collaborators won with the artist Allan Giddy. Part of that process was obtaining a Development Application, in which there was a section for Community Comment for concerned citizens. One of the results of this preliminary evaluation was that the residents stated concern for the local wildlife. As a result, the Australian Museum's Business Services Unit was contracted to perform a survey regarding the habitats of local species in that area, particularly the effect of the light on the figs and the wind turbine on the birds and bats of the areas. Though the results of the study showed minimum impacts on both, there was a threat identified to both birds and bats, so the Australian Museum recommended that the turbine be monitored for at least 1 year, the results of which were collated online as part of a greater data set of aggregated information on wind turbines (Giddy and Snow).[10]

Case Study #2: Forgotten Songs

Michael Thomas Hill's piece *Forgotten Songs* is a work that incorporates art and technology, natural history and memory. Originally part of an exhibition on Hidden Laneways in 2009–2010 curated by Dr. Steffan Lehmann, it is a series of bird-song recordings specific to the species that inhabited the Sydney CBD before European settlers forced them to relocate. These songs are visualized by birdcages and can be heard via digital recordings and speakers (Fig. 15.4).

Hill revealed that, apart from the usual Development Application allowance for Community Commentary, a kind of active evaluation took place as the project neared its end (Hill 2013). This happened by members of the public actively writing emails and making phone calls to the City of Sydney, evaluation which happened outside any prescribed avenues for formal evaluation, making this an interesting example of how unsolicited and unpredictable audience feedback can reshape the life span of a public artwork.

As articulated by Mayor Clover Moore in a letter to council in June 2012 and by council meeting sub-committee in November, *Forgotten Songs* was given the

[10] https://xively.com/feeds/79693

Fig. 15.4 Michael Thomas Hill. *Forgotten Songs*. Digital sound and birdcages. View from the 2nd story. City Angel Recital Hall, 2009–2011 (Image produced courtesy of the City of Sydney)

opportunity to shift from being a temporary public work to remaining a permanent part of the Sydney cityscape. Unfortunately, further details of this active evaluative method, email and other records are no longer easy to locate. Nevertheless, there are still email communications that reveal these requests came from the public to both the digital agency that Michael Thomas Hill directs and the then City of Sydney project officer, Glenn Wallace.

15.3.2.1 Reflections on the Government Model

In this section, two City of Sydney Council commissioned works are presented as case studies of the Government Model, both following similar paths to exhibiting (Fig. 15.3). In responding to Open Calls for Expressions of Interest, applications were submitted that were assessed against council criteria and short-listed (steps 7 and 8). After a winning applicant was accepted, the projects were honed and refined at several further points (steps 9–12). Both *Earth Vs. Sky* and *Forgotten Songs* required Development Applications prior to construction, and part of this process allowed for the local community to have their say in a public forum (step 9). These committee-meeting minutes became important, especially when it came to addressing concerns the local community had over the wind turbine affecting local fauna in *Earth Vs. Sky*, or the end-date of *Forgotten Songs*. In both cases, active evaluation in the form

of community feedback, led to further contemplation by organisers, makers and managers of these works (steps 9–12).

In mapping the process as described above, we discovered that there is currently no summative evaluation undertaken after the work is installed (step 13), and nor are records kept during the lifecycles of the works, in order to determine their effect on audiences, or the satisfaction of the community where the works live. The findings from the data acquisition methods put in place after community comment (step 9) are published mainly on the websites for the work, perhaps only for 1–3 years. They obviously still exist in the tacit knowledge of the parties directly involved, but should key staff members change jobs, the records of this evaluation will be buried in deactivated email accounts or similar. What is required is a way to access the raw data of the projects after the project is installed.

Where the artists involved in these case studies (Mr Snow, Zina Kaye and Michael Thomas Hill) are interested in the life of the artwork after it has been installed, for the majority of administrators involved, and seemingly the community members, the big gain seems to be in formative evaluation leading up to a successful installation. The audience in this model appear to be the community that are local to where the work is to be installed. As long as their concerns are addressed during the development application process, the audience was then no longer an important issue. There appear to be no measures in place that summatively evaluate public artworks after installation, whether to gauge satisfaction or to find out what it makes the audience think or feel.

15.3.3 The Independent Model

Amongst a handful of independent curators operating in Sydney that specialised in digital media from 2007 to 2012, New Media Curation was an initiative that emerged from the Beta_space platform. Two case studies of independent curation of public art undertaken by New Media Curation are reported and reflected on below.

Case Study #1: The Grid Gallery (Fig. 15.5)

The public art projects procured by author Turnbull often involved collaboration with commercial entities, one of which was Ausgrid (a power infrastructure company) in Sydney.[11] Initially Ausgrid approached New Media Curation on a recommendation from a University of Sydney academic, to plan and execute a programme of digital artworks that tied in with the interests of some of their key corporate stakeholders. New Media Curation was responsible for advising on processes for sourcing and liaising with artists (providing them with technical assistance where necessary), and writing themes relating to the interests of key stakeholders and citywide activities. Ausgrid was responsible for providing onsite technical support for a

[11] http://www.ausgrid.com.au/

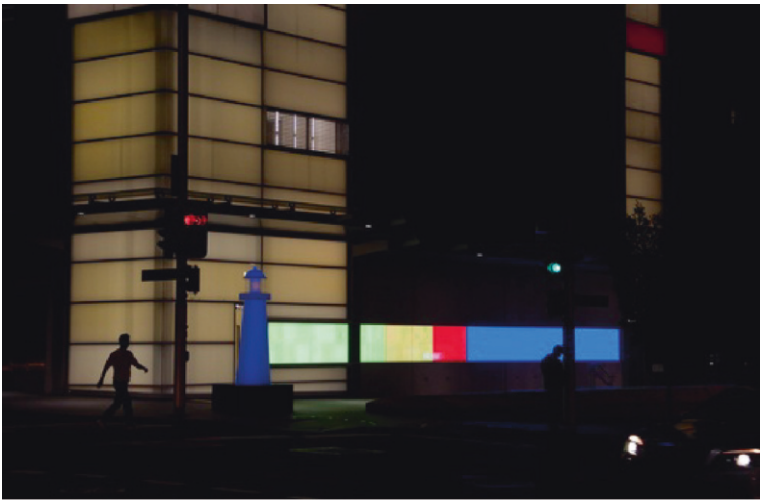

Fig. 15.5 Ernest Edmonds. *Colour Energy*, Grid Gallery. Sydney CBD, Australia: June 2010 (Image courtesy of New Media Curation and printed with the permission of Ausgrid)

16 m × 1 m display screen and for maintaining the technology that operated it. They also outsourced production of a website to advertising firm, Leo Burnett, who devised a site that served as an online gallery and submission service for artists interested in participating in the project.

In terms of the evaluative framework for installing a work at the Grid Gallery, the methodology was mostly formative in nature. Table 15.1 below indicates the roles that the key actors played in determining the creation, submission and exhibition of a digital work. When the Ausgrid Project Manager was asked if there was any formative assessment criteria involved in set up the site of the Grid Gallery, author Turnbull learned that the original architectural plan included a digital screen for advertising, and permission was granted to exhibit artworks as a part of the City of Sydney Development Application. The audience that this 'enlivening' was aimed at was mainly city workers commuting to and from work. With themes developed around Sydney city calendar events and key stakeholder interests the interest of the audience was considered, but not retrospectively evaluated by those who commissioned the works.

Case Study #2: Silverwater Learning Centre

The second project between Ausgrid and New Media Curation concerned two artistic commissions for the Silverwater Learning Centre, a training site for apprentice electricians as well as all other Ausgrid staff. The Centre contained several onsite 'scenario' models for trainee electricians to situate themselves within and learn from, but it also housed an exhibition entitled 'Energy Efficiency and Sustainability'.

Table 15.1 Assessment criteria for the grid gallery platform

Actors	How was criteria for the GG call determined?	How was criteria for the award assessed?	How was the build of each work assessed and how did they move forward?
Ausgrid (funders)	Contracted NMC to develop by:	Board Members accepted or rejected applicants based on:	N/A
	Researched curators specialising in media art	Look & content	
	Rang Turnbull on recommendation from	Ability for Ausgrid technicians to support the technology	
NMC (specialist contractor)	Researched other calls for exhibiting digital public work and created an outline around two key criteria:	One of the Ausgrid Board Members; assessed on:	Provided technical support to the artists and Ausgrid technicians as required
		Reputation of artist	
	Submission must work in low-res digital film environment	Quality of submission in response to call	
	Must submit content along criteria of the theme	Required technological support (could the artwork be produced in time)	
Leo Burnett's (specialist contractor)	Augmented this outline based on what was available via the web-platform:	N/A	Maintained the web platform as an online submission platform and web gallery
	Submission accepted only the file types that were required		
	Generated an email to Ausgrid Board Members at the closing date/time		
	Provided storage and display of works that did not make the shortlist (online gallery)		
Artists (specialist participants)	Saw and responded to call based on:	Assess the criteria for application and display – submit application	Build a low-res artwork to the spec of the screen
	Ability to work in lo-res digital environment	Request assistance where necessary	Uploaded the artwork to the LB web platform and waited on reply
	Had a (near) completed work that could be adapted		Requested assistance as needed from NMC.
	Required minimal digital support/supervision		
	Would work for exposure only		

Within the auspices of these education and training spaces, New Media Curation was responsible for commissioning two artworks: (1) a digital animation suited to Stealth Screen (a low-resolution vertical screen) for the exhibition; and (2) a physical sculpture meant for the courtyard. As the building was 5-star Green Energy rated, the sculpture was to be constructed from recycled materials found at two of the Ausgrid storage facilities that were closing down. New Media Curation issued a nation-wide call and criteria for submission deadlines, along with an invitation to tour the storage facilities and review the materials for any interested artists.

From 21 applications, six projects were shortlisted and presented to a panel comprised of an Ausgrid executive and two experts in design, art, and technology. While there was no particular criteria to be met, the panel understood the aims of the project and the type of works they were looking for. The candidates needed to demonstrate a history of creating public art, the ability to lead a project, and a passion for the mediums being worked in. Table 15.2 suggests an evaluative framework that the actors in this public commission participated in. It reflects the criteria outlined by New Media Curation and the experience and knowledge required of the acting participants (funders, pitch panel, and artists).

From this process, there were two successful artworks selected:

1. Dillon MacEwan and Chris Fox's *Mother of Invention* for the physical sculpture, and
2. Sohan Ariel Hayes' triage of low-res animations *Lightning* won the digital component and is still housed on the Stealth Screen in the exhibition inside the centre (Fig. 15.6).

When information was requested from the Ausgrid Project Manager on assessment, permissions or community comment taking place around these artworks, author Turnbull learned that as the artworks were housed inside the commercial property of Ausgrid, none of this was sought. In a sense, there was more freedom regarding content at the enclosed Silverwater site than at the city-facing Grid Gallery site. The reason being, that with a publicly owned commercial entity, stakeholder views were always a concern and the audiences at each site were divergent.

An overview of how the Independent Contractor Model works for the actors in these case studies involves five stages:

1. Ausgrid pitches creative ideal to the City – receives funding
2. Ausgrid consults and contracts experts
3. Experts run call and create infrastructure
4. Artists qualify and construct work
5. Artwork is launched to its audience – becomes a maintenance issue

Note, however, that the audience, though considered indirectly, is secondary to the act of realising the work.

Table 15.2 Assessment criteria for the Silverwater Learning Centre platform

Actors	How was criteria for the SLC call determined?	How was criteria for the award assessed?	How was the build of each work assessed and how did they move forward?
Ausgrid (funders)	Contracted NMC to develop by:	Ausgrid set the scope of the project and put together an interview panel who understood the scope of the call. Pitches were assessed on:	Sculpture: Ausgrid Project Manager worked closely with the award artists to:
	Working with her on GG and valuing her specialisation and artist network	Proposed content vs./ audience of the works	Provide materials
		Ability for the artist(s) to bring the work to completion as per the call	Assess progress
		Consideration of materials and budget constraints in their pitch	Amend budgets
			Ensure tickets for construction were in place
			Digital work: Ausgrid technicians and NMC worked with award artist to test the build of the digital work to the spec of the screen
NMC (specialist contractor)	Researched other calls for exhibiting digital public work and created an outline around two key criteria:	One of the Ausgrid Panel Members; assessed pitches based on:	Tours of the materials warehouses
	Submission must work in low-res and vertical digital film environment	Reputation of artist(s)	Provided technical and content feedback for the digital work prior to submission
	Artists must be experienced in the construction side of public sculpture and be willing to use recycled materials	Quality of submission in response to call criteria	
		Proposed content vs./audience of the works	
		Ability for the artist(s) to bring the work to completion as per the call	
		Consideration of materials and budget constraints in their pitch	

Artists (specialist participants)	Saw and responded to call based on: Architectural and design experience Construction experience Ability to work in lo-res digital environment Must be a new work Required minimal support/supervision Would work for a small fee	Assess the criteria for application and display – submit application Request assistance and communicate feedback where necessary	Construct the physical sculpture as pitched Build a low-res artwork to the spec of the screen Requested assistance as needed from NMC & Ausgrid.

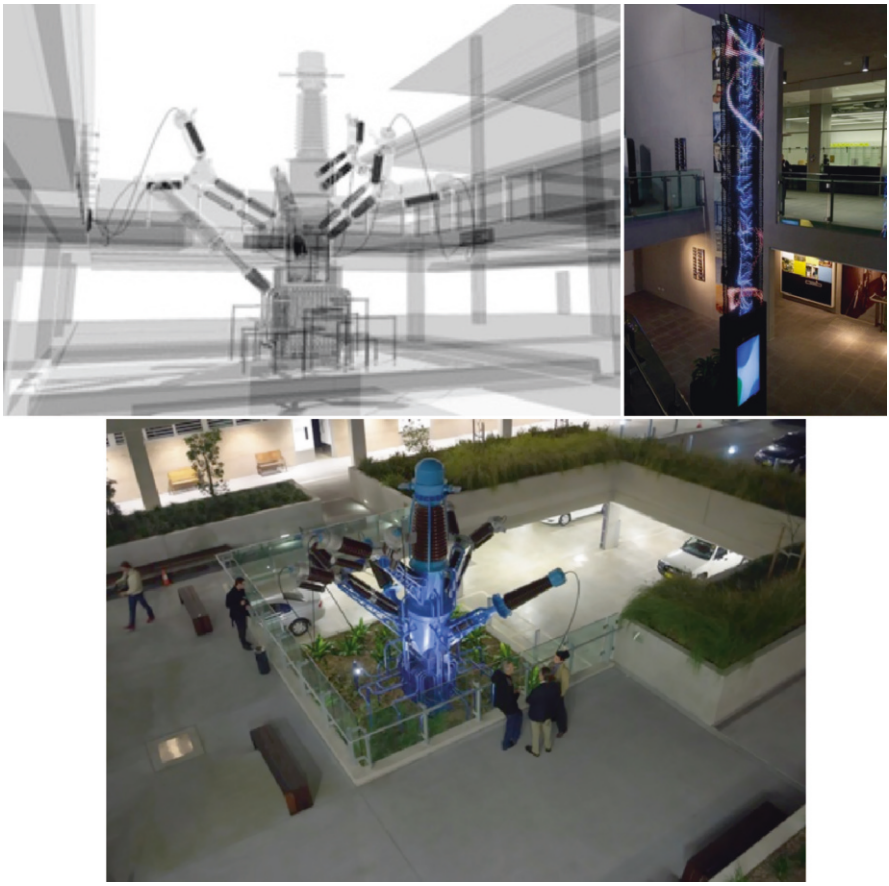

Fig. 15.6 Chris Fox, Dillon MacEwan and Sohan Ariel Hayes. *Mother of Invention* and *Lightning Series*. Finalists in the Silverwater Learning Centre commissions for sculpture and animation. Silverwater NSW: August 2011 (Images courtesy of Chris Fox, Dillon McEwan and New Media Curation. Printed with the permission of Ausgrid)

15.3.3.1 Reflections on the Independent Model: Curator as Contractor

The Independent Model encapsulates both formal and reflective evaluation criteria. As shown in the case studies of the Grid Gallery and the Silverwater Learning Centre commissions, the client, Ausgrid, was somewhat beholden to different criteria depending on the site-specific location of the work. If a work was public and meant to "enliven the street frontage" of a power grid, as Grid Gallery was, a Development Application was lodged with the City of Sydney and consent conditions were adhered to. The commissions for the exhibition and courtyard sculptures at the Silverwater Learning centre were meant for the edification and inspiration of Ausgrid staff and were housed inside their commercial property, and therefore no consent from

external parties was required. The Project Manager would simply need to make the design decisions based upon consultation of experts and with the interests of the stakeholders in mind.

15.4 Conclusions

This chapter set out to describe some models of how digital public art is commissioned and managed with the aim of revealing the role that audiences and evaluation play in its development and exhibition. The specific cases were mainly located in Sydney, Australia, but the models and approaches to evaluation could equally apply to similar contexts elsewhere. Frameworks for this work are represented as three different models, each of which has its own requirements and evaluation criteria. In presenting our curatorial perspective spanning all three models, we are articulating both the rhythm and the reason that characterises digital public art in contemporary environments. Each model has its strengths: within the Museum Model, there is more space for experimentation. Living laboratories such as Beta_space allow for alternate platforms to develop ideas and permanent exhibitions. Through festivals, competitions, and external partnerships, ideas, prototypes and live research provide a rich environment with many iterative cycles and available participants for audience evaluation. As such, the frameworks for evaluating museum audiences are now well established, as represented by the *Beta_space* and *Articulated Head* case studies.

The Government Model addressed the commissioning of public art through a city council based program. Here the two case studies (*Earth Vs. Sky* and *Forgotten Songs*) examined how artists and technologists collaborated to apply for and create artwork with the community in mind. In this model, the audience is considered in the preliminary or formative elements of the work, with the opportunity to affect and instigate an iteration of the work prior to installation. With *Forgotten Songs*, it is interesting to note that informal audience evaluation worked to extend the life of the artwork, but also that there was no formal or summative evaluation avenue set up to identify works that should be retained from temporary exhibitions on a more permanent basis. This ad-hoc evaluation consisted of members of the community hearing that the work was due to be removed and acting to recommend to the council that it remain in place.

The Independent Model is mainly reliant on external expert opinion. The two case studies (*Grid Gallery* and *Silverwater Learning Centre*) explored how commercial entity Ausgrid contracted experts to create gallery infrastructure and bring artworks through the application and assessment process, and finally to display. Where the audience for each site was considered initially in terms of content or execution of the work, once the works were up, there was no process or interest in evaluating the work as they were meant to remain permanently installed. As such, a summative evaluation was not deemed necessary.

In comparing the three models, the better opportunity for a creative practitioner would be dependent on what their intention was for display: the reason for their contribution to the rhythm, if you will. Where there is perhaps little dispute that the Museum Model is the safest, least expensive, and provides the most controlled environment after the artists' own studio, there are benefits to each model. If an interactive artist wants to iterate an early or complex idea based on scientific systems or test a prototype for public reaction, they might utilise the Museum Model. If they want to create a work that would remain a part of the cityscape, in a temporary or more permanent capacity, they might utilise the Government Model. If they have an idea in response to a call for works from a colleague acting on behalf of a larger corporation, understanding they might be more heavily involved in setting the criteria, even bringing their expertise to the table as part of setting the criteria, they might risk working with the Independent Model. In reviewing and revealing the current practices in commissioning, managing, and at some stages, evaluating digital public art, we are able to create a better, more meaningful infrastructure for the audience of today and the future encountering challenging and engaging digital art experiences.

References

Bilda Z, Turnbull D (2008) Beta_Space manual. Quarterly report to the Australasian CRC for interaction design. QUT, Brisbane

Candy L (2012) Evaluating creativity. In: Carroll JM (ed) Creativity and rationale: enhancing human experience by design. Springer, New York, pp 57–84

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

City of Sydney. Commissioning new works. http://www.cityartsydney.com.au/cityart/about/CommissioningNewWorks.asp. Accessed on 12 Aug 2013

Gibson R (2010) The known world. TEXT: No. 8. Special Issue Website Series. Creative and practice-led research – current status, future plans. http://www.textjournal.com.au/speciss/issue8/content.htm. Accessed 11 Oct 2013

Giddy A, Snow. Earth V sky. http://hollysydney.com/art-technology/earth-v-sky. Accessed 12 Aug 2013

Hill MT. Forgotten songs, 2009–11. http://www.cityartsydney.com.au/cityart/special/ForgottenSongs.asp. Accessed 12 Aug 2013

Hill MT. Lightwell. http://lightwell.com.au/. Accessed 21 August 2013

Hill MT. Personal Communication, 2013

Kaye Z, Snow. House of laudanum loves you. http://hollysydney.com/. Accessed 21 Aug 2013

Lacy S (ed) (1995) Mapping the terrain: new genre public art. Bay Press, Seattle, Washington

Muller L, Edmonds E, Connell M (2006) Living laboratories for interactive art. CoDesign 2(4):195–207

Postman N (1994) Museum as dialogue. In: Kavanagh G (ed) Museum provision and professionalism. Routledge, London

Russell R, Winkworth K (2009) Significance 2.0: a guide to assessing the significance of collections. Collections Council of Australia, Ltd, Rundle Mall, SA, Australia

Sheridan JG (2014) Digital arts entrepreneurship: evaluating performative interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 243–259

Turnbull D, Connell M (2010) Prototyping places: in conversation. Recorded and transcribed interview from 10 Dec 2010. http://www.newmediacuration.com/blog/. Accessed 14 Aug 2012. ©New Media Curation, Sydney, Australia

Turnbull D, Connell M (2011) Prototyping places: the museum. In: Candy L, Edmonds EA (eds) Interacting: art, research and the creative practitioner. Libri Publications, Faringdon, Oxfordshire, UK, pp 79–93

Turnbull D, Connell M (2012) Curating digital public art: in conversation. Recorded and transcribed on 17 August 2012. ©New Media Curation, Sydney, Australia

Turnbull D, Smith N (2012) Curating digital public art: in conversation. Recorded and transcribed on 30 August 2012. ©New Media Curation, Sydney, Australia

Chapter 16
Digital Arts Entrepreneurship: Evaluating Performative Interaction

Jennifer G. Sheridan

Abstract Evaluation is key to understanding Digital Arts Entrepreneurship. In this chapter, I explore my own experience of performing Digital Arts Entrepreneurship and how evaluation is vital to turning creative ideas into business opportunities from the boardroom to the muddy fields of music festivals. My goal is to provide criteria for others to use as a lens for evaluating their own performance in the emerging field of Digital Arts Entrepreneurship. I show that this process can be described through free-flow narrative reflection of one's own creative thinking and practice and I give practical examples of selection criteria for the evaluation of Digital Live Art. I describe how performing entrepreneurship is about the boundless pursuit of high-risk yet perceived low-value opportunity and turning it on its head. Additionally, this chapter provides a useful background discussion of the field of entrepreneur scholarship and of some of the emerging initiatives in the United Kingdom that are incubating this creative field. This chapter addresses those working in the Digital Arts, in both industry and academia, but especially those working somewhere in between.

16.1 Introduction

My goal in this chapter is to describe why evaluation is key to understanding Digital Arts Entrepreneurship. As such, I have not set out to define the attributes of a Digital Arts Entrepreneur. Merriam Webster defines *entrepreneur* as "a person who starts a business and is willing to risk loss in order to make money.[1]" Does one ever start a business not to make money? (Even a charity must cover its losses). My position is

[1] http://www.merriam-webster.com/

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that defining the attributes of an entrepreneur is akin to defining the attributes of an artist. Like artists, most 'entrepreneurs' identify with inventing, developing, creative thinking, making, problem solving and researching (among many other things) – and the label 'entrepreneur' is what other people use to describe them. Indeed, I agree with Williams (2010) that entrepreneurs do not exist but rather that one *performs* entrepreneurship. So rather than setting out to characterise the attributes of an entrepreneur, in this chapter I focus on *performing entrepreneurship* within the context of Digital Arts. My assertion is that Digital Arts Entrepreneurship and its key evaluation criteria can only be described through free-flow narrative reflection of one's own creative thinking and practice, and as such, it is necessary to turn our attention from the *what* to the *how* of Digital Arts Entrepreneurship – *how does one perform entrepreneurship*?

My narrative approach borrows from Entrepreneurial Narrative Theory, which Gartner (2007) loosely defines as a text (in its broadest sense) written by entrepreneurs about entrepreneurs. In using a quasi-Gartner approach, I attempt to pinpoint the key evaluation criteria that I created while successfully transitioning into the world of entrepreneurship. Note: dedicating time to write this chapter was not easy – it is usually not part of a CEO's day job! But that is exactly the point: we are only beginning to understand that Digital Arts Entrepreneurship is an emerging practice itself and so it requires much deeper consideration and reflection. In this chapter, I will provide readers with a first-hand account of how I performed entrepreneurship whilst transitioning from academic-focused practice to industry-focused contexts, and in doing so, start the dialogue about how Digital Arts Entrepreneurship is performed. As my perspective comes from growing a successful Digital Arts business in the United Kingdom, I begin with brief description of the recent initiatives in the UK that are giving rise to entrepreneurship in general.

16.2 Background

Entrepreneurship in the UK is on the rise. In 2011, The Global Entrepreneurship Monitor (GEM)[2] reported that for the first time since GEM records began (1999), more than a fifth of working age individuals either intended to start a business within the next 3 years, were actively trying to start a business, or running their own business. Over the last few years, the UK government's small and creative business initiatives, such as the UKTI Global Entrepreneur Programme,[3] the Tech City[4] initiative and the SIRIUS programme,[5] continue to attract internationals with creative talent and skills to the UK. In cultivating these initiatives, the UK has seen a rise in: the expansion of venture capital financing; successful incubation spaces such as Tech

[2] http://www.gemconsortium.org/

[3] http://www.ukti.gov.uk/

[4] http://techcity.io/

[5] http://www.siriusprogramme.com/

Hub and The Trampery; multiple accelerator programmes such as Springboard, Seedcamp, and The Bakery; and, a growing list of public events for exploring Digital Arts such as Digital Shoreditch and the Tech City Entrepreneurship Festival among others. However, while these creative business initiatives are gaining momentum, we know little about Digital Arts Entrepreneurship itself.

The study of entrepreneurship is defined as *entrepreneur scholarship* and while multiple theoretical and methodological traditions exist in entrepreneur scholarship, there is a lack of common agreement of the definition of entrepreneurship (Davidsson 2004; Hill and Levenhagen 1995). However, recent scholarship is revisiting a social theory of entrepreneurship (Down and Reveley 2004). Peverelli and Song (2012) describe entrepreneurs as social actors "who 'create, discover, and exploit value-adding opportunities'" whereas Down and Warren (2007) describe entrepreneurial identity as the interaction between the individual, society and culture, rather than any individual identity. They suggest that those who make a living from their own endeavour will do so on the basis of interaction with others.

> If we want to gain insight in entrepreneurship, we need to focus on the social identities of the entrepreneurs, the social influences from other actors that together make certain persons decide not to derive their income from employment, but from his or her own enterprise (Peverelli and Song, p. 17).

Others suggest that the purpose of entrepreneurship is about "driving changes in the historical context of business, industry, and the economy" (Jones and Wadhwani 2006). As Candy discusses in Chap. 3 ("Evaluation and Experience in Art") (2014), evaluation involves understanding the value of something. To understand the value of Digital Arts Entrepreneurship, I propose constructing my narrative around the following questions:

- Who are the performative actors involved in the Digital Arts Entrepreneurship eco-system?
- How are creative value-added opportunities explored?
- How does one make a living through Digital Arts Entrepreneurship?
- How does Digital Arts Entrepreneurship signal historical change, if at all?

16.3 Low-Risk and Gestating the Unconventional

The narrative begins in 2001, when I began a PhD in a traditional Computing Department at a campus-based university in northern England. Whilst the university itself did not offer any formal programmes in Digital Arts at the time, I had the support of supervisors whose track record and reputation in Computing provided a low-risk environment in which to gestate and seed unconventional and creative ideas. Being at a campus-based university meant that students from different departments mingled regularly so that individual research was often discussed through the lens of different disciplines. From this blended environment emerged a loose network of people interested in cybernetics, and in that context I proposed the idea of hosting a

live and Public Art event which explored the performative in cybernetics. I contacted the Performance Artist Stelarc[6] to champion the event and when he agreed, I developed Art-Cels: A Three-Day Celebration with Stelarc (2002).[7]

As my core research interest was in wearable computing, Live Art and club culture (e.g. interaction at festivals or nightclubs), I called on local Live Artists, Arts centres, and several free-party decorators, DJs and musicians to participate. For the performance event, I mobilized a team of computing experts from within my Computing Department and we called ourselves .:thePooch:..[8] We shared roles and responsibilities equally, including programming, designing, building, purchasing, prototyping, etc. However, in addition to building and performing, I took sole responsibility as event director. A small amount of funding from the Computing Department was used to cover minor costs such as venue hire and security staff however the majority of services and resources were voluntarily supplied. My approach was to have a few planned performances (like those described in Chap. 7 ("Intimate aesthetics and facilitated interaction" by Loke and Khut (2014)) but more importantly, my purpose was to encourage performance artists to simply turn up to the event and perform in any manner that they wished. In this way, the event was structured as a "happening"[9] – focusing on *liveness* and the unanticipated performances that emerged between the artists and the audience.

My open-ended approach baffled more than a few people at the time. Some of asked *Is this Art*? or *What is the value for Computing?* And both the Arts community and the Computing community wanted to know – *Who is leading this Art/research*? To my knowledge, my own Computing Department had never participated in a Live Art event. In this sense, both the Arts and Computing communities did not immediately see the value in my ambitious plan.

16.3.1 Validation

So with this encouragement came a request for validation. In order to legitimize the research, it was necessary that I performed some kind of evaluation. My scenario presented an interesting problem; since I was not conducting a conventional scientific study, I was unsure as to how to collect and evaluate my data. Conventional empirical research seemed inappropriate for this type of study.

As mentioned above, my goal was to investigate the intersection of wearable computing, club culture and Live Art. Live Art is a term that is often eclipsed by its more popular parent term Performance Art and emerged as an 'unconventional' art form after Allan Kaprow coined the term happenings. It focuses on presence or liveness: the Live Artist, her body and her bodily actions rather than on material objects

[6] http://stelarc.org

[7] http://www.art-cels.com

[8] http://www.thepooch.com

[9] Allan Kaprow first coined the term "happening" in the spring of 1957.

(Schimmel 1998), as well as the relationship between the artist and audience. Importantly, in Live Art, the performer *is* the artist (Goldberg 2001) not a character and content rarely follows a narrative.

Despite a lengthy literature search, I was unable to find any examples in the field of Human-Computer Interaction that described similar research within the context of club culture (Sheridan et al. 2004) and as such, I saw an opportunity to create new methods and theories in this area. As a result, I decided prior to the event that I would not only observe interaction between participants, performers and observers and record the data on paper and with a video camera but, more importantly, I would embed myself and others as part of the performance, using wearable computers as tools for mediating these interactions.

16.3.2 The Birth of Wittingness

In the few weeks leading up to Art-Cels, .:thePooch:. developed two wearable computing performances: (1) A planned performance between several members of the collective where one user (or 'cyborg') was outfitted with an electronic communication display and yet this display was visible to others not the cyborgs themselves; (2) my own planned and individual performance where I wore a wearable computer with a head-mounted display (HMD – not unlike a Google Glass[10] display) and interacted directly with the audience (Fig. 16.1).

As discussed earlier, the intention of both performances was to model the interaction that occurred between observers, participants and performers and I have described this at length (Sheridan et al. 2004). More importantly, it was a third performance which I had not planned, but which I was implicated in, that had the most impact not just on my own research going forward, but would be adopted by many others.

During Art-Cels, as I was talking to a bystander, I noticed that my wearable computer started 'acting funny.' In my HMD I observed that my cursor seemed to be drifting across the screen, and folders seemed to be jiggling back and forth. Since I had had my HMD on for a good part of the day and the evening, I assumed that the problem was probably that the hardware was overheating. Rather than break away from conversation, I decided to continue my conversation and to fix the problem later. I continued monitoring the situation in my periphery but as the problem intensified, I began to lose track of my conversation with the bystander and to become completely distracted by what was happening on my HMD. Although I thought my distraction was undetectable to the spectator, he noticed, and then asked me if something was wrong. I said that my wearable computer was overheating and we simply continued on with our conversation.

[10] http://www.google.co.uk/glass/start/

Fig. 16.1 My wearable computer with a MicroOptical head-mounted display (*HMD*) (*top left*) used at Art-Cels; platform boots with battery power (*top right*); and interacting with witting participants (*bottom*) (©2002 .:thePooch:.)

Shortly afterward, and quite suddenly, a personal message appeared in my HMD: "Hello Jenn," it said. I froze. Before I could respond, my cursor moved backwards deleting the message as quickly as it appeared and another message replaced it:

"Who is that you're talking to with the moustache?" My confusion suddenly changed to a feeling of overwhelming excitement and I let out a yelp. The bystander cocked his head to one side and asked me about the problem.

"I'm being hijacked," I said very matter-of-factly. He laughed. I continued, "No really. Someone is watching us and has taken over my wearable computer." He let out a nervous laugh, paused and glanced about around the room in disbelief. Then he squinted and pointed at my HMD and said,

"What, with that thing?"

One has to remember that the year was 2002 and even having access to a laptop, let alone the promise of Wifi and the idea that someone could walk around a room and wirelessly communicate with others on a computer that they were wearing was to the average person the stuff of science fiction.

I spent the rest of Art-Cels playing a subversive game with my hijacker who was commenting on and directing me to engage with the unwitting bystanders around me. Unwittingly, I was pushed into a live performance. This was my first real experience of tripartite interaction in Digital Live Art – or rather the interactions that occur when one transitions from unwitting observer to witting participant and then on to performer (Sheridan et al. 2004). The performative experience, and my reflection of it, became the underpinnings of the evaluation methods and theories of performative interaction, wittingness and the Digital Live Art framework that I still use today. I elaborate on these methods and theories in the next Section.

16.3.3 Modelling Digital Live Art

My experience at Art-Cels introduced to the field of HCI two performative concepts: first, the concept of performance framing; and second, a description of the transitions in observer-participant-performer interaction in Digital Live Art. The concept of performance framing was first identified by Gregory Bateson in 1955, although Goffman's (1974) ethnographic research of performance framing is the most widely referenced in HCI. In using Bateson's description of the performance frame (e.g. a cognitive context where all the rules of behaviour, symbols, and their interpretations are bound within a particular activity within its own structure) against the backdrop of the Art-Cels wearable performances, I proposed the following fundamental questions for evaluating Digital Live Art:

- How are observer, participant and performer relationships negotiated using digital technology?
- How does one transition between observer, participant and performer with and without using digital technology?
- What effect does context and environment have on these negotiations and transitions?

I created a visual representation of these questions called the Performance Triad Model (Fig. 16.2).

For the next several years, I collaborated with academics to expand and improve the Performance Triad Model and to introduce a descriptive framework for considering people's wittingness, technical skill, and interpretive abilities (Table 16.1) (Sheridan 2006; Benford et al. 2006) in the fields of: formal methods (Dix et al. 2005); human-computer interaction (Sheridan et al. 2007); tangible interaction (Sheridan and Bryan-Kinns 2008); pervasive and ubiquitous computing among others. The evaluation criteria can be used at any stage of the design process or even when reviewing submissions for a live performance event. For example, when thinking

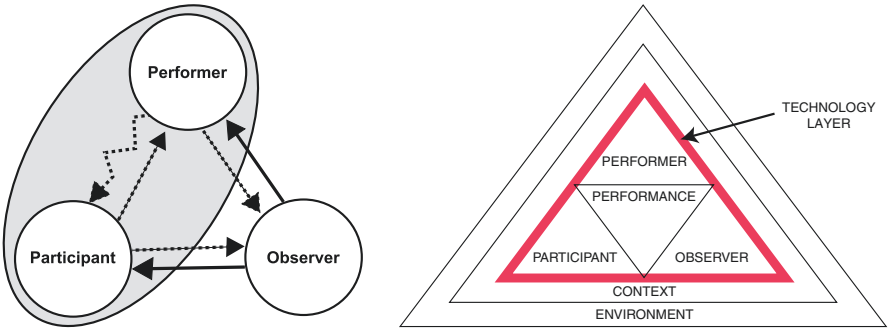

Fig. 16.2 Model of tripartite interaction (*left*) and the Performance Triad Model (*right*) first introduced in (Sheridan et al. 2004) which formed the evaluation criteria of performative interaction, wittingness and Digital Live Art (Sheridan 2006)

Table 16.1 Criteria for evaluating transitions in performative interaction

	'Front of house' behaviours		
	Wittingness	Technical	Interpretive
Performing	How does one manipulation the performance frame?	What are the skills required to manipulate the frame?	How does one make the performative activity uniquely their own (embodiment of skill)?
Participating	How does one choose to enter into framed behaviour?	How does one acquire and execute simple routines to interact with the system and others?	How does one lack the interpretative skill of performance (do not attempt to convey meaning through interaction)?
Spectating	How does one become aware of the performance frame, and why do they choose to enter as an observer?	What are the indications that one is choosing not to demonstrate any skill with respect to the performance frame?	What are the indications that one is choosing not to attempt to convey meaning with respect to the performance frame?
Bystanding	What are the indicators that one is unaware of performance frame?	What are the indications that no technical ability is being applied?	What are the indications that one is not making attempts to convey meaning?

about how to design a performance one can use the criteria to evaluate how a person who is unaware of the performance frame might become aware of the frame and thus choose whether or not to join in the performance. The criteria works equally well when applied after the performance to consider whether or not the design was successful in encouraging this transition.

Interestingly, my models and criteria were initially rejected from several Human-Computer Interaction (HCI) conferences; despite comments on how well written, the reviewers did not see the research as adding value to the field of HCI (see *Discussion* in Sheridan et al. 2004). One reviewer asked how the interaction was different to interaction with an ATM machine (!), and another asked how the interaction was different to wearing a 'kick me' sign on one's back. Despite how ridiculous these comments seem now, what is important to note here is that these reviews confront an important aspect of evaluation: perceived value. In my initial attempts, I was unsuccessful in convincing the reviewers of the value of the emerging research, and as such, the reviewers in turn saw accepting the paper as a too high-risk. But…

16.4 Where There's Rejection, There's Opportunity

At this point, I could have abandoned this line of inquiry but instead, my experience with the actors involved, the overwhelming attendance figures, and my background research convinced me that there was indeed an opportunity worth pursuing. I recognized that what was missing was greater legitimacy of the value of the research to both the Arts and Computing communities.

The Arts and Humanities has a history of theoretical writing on performance-technology crossovers, for example Auslander's (1999) discussions of live performance and music; Saltz's (1997) and Rush's (1999) descriptions of interactivity, performativity, and computers; and, Hill and Paris' (2001) research on guerrilla performance and multimedia. In addition, Art-Cels gave me the opportunity to meet and invite a local university lecturer writing about technology and Art to interview Stelarc (Giannachi 2004). I realised that in order to further validate my research, I would need to reach out to someone from the Arts and Humanities who would champion the work in that particular field. As such, I enlisted a researcher from the Arts and Humanities to assist in re-writing parts of the paper and it was accepted a year later (Sheridan et al. 2004).

16.4.1 Public Acceptance as a Measure of Value

In Public Art, the value of public acceptance (and in some cases rejection) cannot be underestimated. Although timing is an important factor, it an element that is hard to predict and as such external influences can categorize potential innovative research as too high-risk. For example, when funding is released for a particular area of research or pushed by a particular agenda, then unless one shifts with these movements, one risks being unfunded or underfunded. However, part of Digital Arts Entrepreneurship is to use evaluation to convince others that what one is doing is a low-risk activity, whilst still being valuable. This requires one to be resourceful,

and is a hallmark of Digital Arts Entrepreneurship; my work with the collective .:thePooch:. is a good illustration of being resourceful to increase value.

.:thePooch:. continued its collaborative activities for several years, producing a growing body of artwork, exhibits, and network of people. Yet several attempts to obtain funding through the usual academic routes were unsuccessful, as the work was seen as too risky to fund. We collectively had an unwavering determination to continue our activities despite the rejection, so we either self-funded our work, or funded our activities with 'left-over' bits of funding from other people's projects. In the latter case, the sharing of resources often meant a sharing of ownership. In other words, if we agreed to take a bit of funding to exhibit the artwork or activity, then we agreed to whomever gave us the funding that they could communicate their involvement in our activities. Perhaps I'm stating the obvious here, but it is indeed a very important point in Digital Arts Entrepreneurship and one that must be addressed going forward:

> To be successful in Digital Arts Entrepreneurship one needs to understand how to manage risk and opportunity with ownership.

Why is this important to evaluation? Well, with each new funded exhibition, artwork or performance, I was able to conduct an evaluation and therefore not only improve the evaluation criteria first explained in the Performance Triad Model but also integrate it with research that was following a particular agenda or research area (as in Table 16.1). Doing so increased the acceptance of my activities among researchers in field of HCI and the work began to be seen as a low-risk activity.

When .:thePooch:.'s work began being perceived as a low-risk activity, we were pursued by Arts agencies wanting to manage us; photographs of our work began appearing in university PR campaigns; and, academics began writing about us in textbooks and papers. In other words, our repeated activities convinced my communities that my research was not only worth pursuing but valuable. Around the same time, similar performance-technology explorations in the UK, such as mixed-reality games (Koleva et al. 2001; Flintham et al. 2003) as described in Chap. 13 ("Evaluation in Public Art: The Light Logic Exhibition"), by Alarcon-Diaz et al. (2014) were gaining wide support not just in Computing and academia, but more importantly, winning attention from the Arts and the general public. This endorsement from the Arts and the general public signalled a shift change:

> Performance-technology crossovers have shifted from high-risk to low-risk activities and have emerged as a way of demonstrating value in Digital Arts.

And then a curious thing happened.

16.5 Stranger Things Have Happened

What happened next, signalled a step change and the chance for seeding new ideas and opportunities: .:thePooch:. experienced a period of organic growth where people who weren't even part of our collective began saying that they were. I became a

"witting observer" (Sheridan 2006) of our success. These transitions in performative behaviour (Sheridan 2006; Sheridan et al. 2007) signalled an awakening of my entrepreneurial thinking.

Unwittingly, after several years of developing unfunded and mostly self-directed research, I turned rejection into an opportunity. I was driven not just by a belief or thinking that what I was doing was significant, but more importantly by having to convince others that an opportunity existed and bringing those on board who were ready to support my claim. In any case, armed with my now established network of respected actors, and the general perception that my activity was low-risk and popular – I began the laying the groundwork for defining the field of Digital Live Art (Sheridan 2006), and unwittingly, Digital Arts Entrepreneurship.

This success signalled the next significant turning point in my entrepreneurial journey: the question became: *Can I make a living by doing and creating Digital Live Art?* For some people, the thought of leaving behind a steady income, an emerging academic career, and even the idea of becoming a 'corporate' producer of Digital Live Art was being a 'sell-out' and undesirable. For me however, my entrepreneurial spirit kicked into high gear and what was once a body of informal research now became a full-time pursuit. BigDog Interactive[11] was formed.

Soon after, interest and funding for the Digital Arts in the UK increased almost overnight with new platform grants, centres and training programmes emerging across the country (see Chap. 13 "Evaluation in Public Art: The Light Logic Exhibition", Alarcon et al. 2014). As I continued to publish my work in academic circles, combining my original model with my collaborative work emerging through Equator (Dix et al. 2005; Benford et al. 2006) I noted that the number of lines of inquiry, particularly in the area of performative interaction in HCI, were both increasing and splintering at the same time (Jacucci 2004; Reeves et al. 2005). This signalled another opportunity. Despite the amount of theoretical writing going on, there was an opportunity to develop new design thinking and practice. During this time, I came up with the idea of Chindogu Challenge[12] (2005) – an extreme unuseless prototyping event, after running several internal events through .:thePooch:. such as Scrapcomp Challenge (2002) and No One Opens Attachments Anymore (2003). The event was a kind of 'hackfest' for human-computer interaction academics with the purpose of challenging them to use an unfamiliar creative framework to develop Chindogu (Fig. 16.3). Importantly, each team was asked to perform at several points during the event; at least one member of the group had to participate in a 'Boast Off', which meant that they had to stand in front of all of the other groups and boast about how they were going to win the challenge because their design was fantastic. This proved to be a hugely popular and quite a humorous part of the event.

Once again, I became the witting observer of my success: Chindogu Challenge caught international attention. In seeding the concept, it was starting to get repeated by others without my involvement – it was growing organically and with it, its value. This shift in value and growth, i.e. the perception that high-risk activity was

[11] http://www.bigdoginteractive.com

[12] http://www.thepooch.com/Events/chindogu.htm

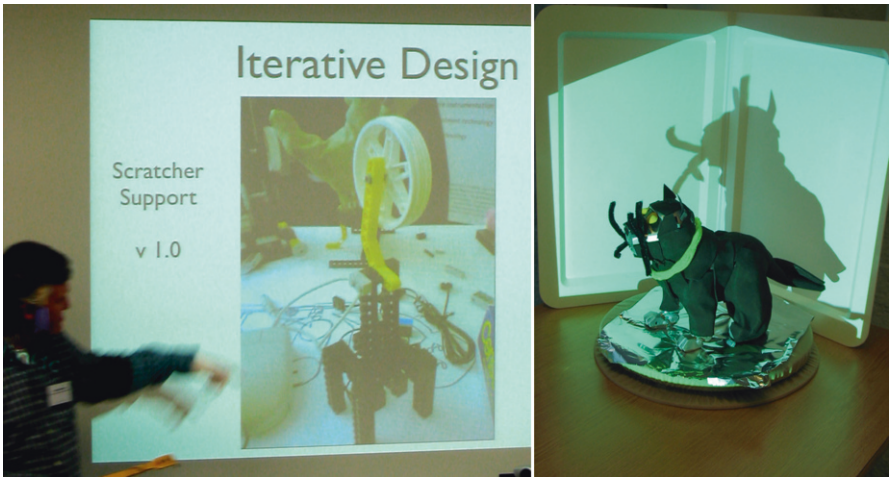

Fig. 16.3 Chindogu Challenge is a hackfest of creativity, computing and Art and includes the performative 'Boast Off' (*left*) and results in designed Chindogu (*right*) (©2005 .:thePooch:.)

beginning to shift to low-risk, signalled to me that it was perfect time to do something high-risk that would be perceived as low-risk. So, I took my body of research and created a new opportunity – the (re)Actor Conference Series on Digital Live Art.[13] Without any funding to support the events, I found venues that would provide the space, and approached the people who were echoing my research: in the first instance the leading annual human-computer interaction conference in Europe (British Computer Society Conference on Human Computer Interaction, BCS-HCI established in 1985), which could then provide a high-value network of people. More importantly, doing so allowed me to provide small commissions or subsidize some artists to attend and perform at the events.

This is a key point. Often the number of unfunded and underfunded people with high quality and high-risk Digital Arts performances and installations far outweigh funded people who come to the event and show poor quality, low-risk demonstrations. Digital Arts demonstrations often feel like a sideshow, rather than the work being an end in itself. The problem here is that presenting poor-quality (but often well-funded) demonstrations as Digital Art devalues Digital Art in general. It is absolutely vital to begin to use evaluation criteria, like those presented in this chapter, for critically analysing, selecting and teaching about work that best represents high quality Digital Art, or we risk devaluing the field.

Indeed, in creating (re)Actor, I was selecting, reading, watching, hearing (essentially living and breathing) Digital Live Art. Over time, I was unwittingly developing a keen sense for not only spotting an opportunity, but also evaluating the opportunity for others. In performing entrepreneurship, I was balancing the perceived risk and value for all people involved, quite a heavy (and often thankless)

[13] http://www.digitalliveart.com

task, and not unlike the curatorial activities described in Chap. 15 ("Curating Digital Public Art") by Turnbull and Connell (2014).

Although the Digital Live Art conference series was originally intended to be more like Art-Cels where anyone could turn up and perform in any manner they wished, because I had sought to fund the conference by running it in partnership with a larger conference series (BCS-HCI), the submissions went through a vetting process. It was then that I (and the other reviewers) began applying my own evaluation criteria to select the best work. The evaluation process applied the criteria from the Performance Triad Model, and most importantly that the work must allow for tripartite performative interaction:

- How does the work allow for people to experience the transitions between observing, participating and performing?
- If it does not, how can we suggest they change the work to do so?

In many cases, the artists and academics who submitted work requested that their work be shown as a demonstration, interactive installation or an exhibition piece, but certainly not a performance. Indeed when I suggested that they re-submit the work as a performance, most immediately rejected the idea or expressed discomfort at the idea. However, it simply did not make sense to me to curate an event deemed 'Digital Live Art' where most of the works were interactive installations or demonstrations without any real performance at all. And using my own Performance Triad Model, it was easy for me to see how many of the submissions would benefit from being pushed into a live, performative context.

16.5.1 Pushing Performance Creates Digital Arts Entrepreneurs

The performative event that I co-curated at the Berkeley Art Museum (BAM) for Creativity and Cognition 2009, is a great example of how pushing for performance leads to Digital Arts Entrepreneurship. The evening event began in the BAM theatre – a space designed for happenings in the 1960s. Several live performances took place, however, I will highlight two that I thought worked particularly well as Digital Live Art. Jay Silver's staged performance *Nature as Interface: MacGyvering Interactivity with Trees, Pencils, Grandpa, Even the Kitchen Sink* (Silver 2009) was originally submitted as an installation but I asked him if he could create a staged performance of the work. In the days leading up to the event, Jay created a performance that invited audience members on stage with him to perform by turning everyday objects such as fruit, into musical instruments. Not only did Jay's performance prove popular that evening but also he has gone on to be hugely successful in performing Digital Arts Entrepreneurship after a very popular Kickstarter campaign).

Likewise, Di Mainstone's (Fig. 16.4) work which investigates the landscape between ad-hoc performance, communal experience and wearable architectures, first came to my attention when she submitted her work to the Third (re)Actor conference

Fig. 16.4 Di Mainstone's *Shareware* performed at (re)Actor3 (Photography by Pixelwitch ©BigDog Interactive)

series as a demonstration or installation. Again, I pushed for her to perform the work rather than simply exhibit it and she agreed and since then she has gone on to create and perform an enormous body of work including a performance at CC'09 *Addressing the Unexpected* (Mainstone 2009).

I, by no means, am taking credit for their successes! My point here is that both Jay and Di embraced the challenge to perform and were able to manage the risk and validate their work in front of a critical audience. I'm quite certain that neither of them performed the work in the context of the dictionary definition of an *entrepreneur* i.e. to make money. Yet both are shining examples of the new breed of artist who is exploring Digital Arts Entrepreneurship using a different approach to my own. However like my own practice, and from my perspective, both Jay and Di have always unwittingly performed entrepreneurship.

As the popularity and opportunities for performing Digital Live Art have increased, such the exemplified in the popularity of the (re)Actor conference series, one would expect that I would be elated to sit back and watch it grow. But oddly, I feel quite the opposite. Instead, without really understanding why, I constantly have a nagging and overwhelming craving to shift gears.

16.6 Time to Move On

Several years have passed since I began, albeit unwittingly, exploring Digital Arts Entrepreneurship. I am happy to report that in those years many of the people that I have worked with or supported have shown their Digital Art displayed at significant

venues while others have gone on to enjoy prestigious commercial, artistic or academic careers. But this is not a measure of value for Digital Arts Entrepreneurship. I, like many others actively performing entrepreneurship, am less interested in the glossy photos, citations, or even stable job that often follows success – no matter how attractive it may seem.

> Performing entrepreneurship is about the boundless pursuit of high-risk, (perceived) low-value opportunity and turning it on its head.

And this is a necessary part of the Digital Arts Entrepreneurship journey, albeit a difficult one:

> When low-risk, high value perception is achieved, it's time to move on.

With this in mind, I urge readers to consider the part that Digital Arts Entrepreneurship plays in academia, artistic practice and industry, and in the spaces in between. For me, Digital Arts Entrepreneurship:

- Provides a social eco-system for encouraging and gestating high-risk activities and flourishes in high-risk and (perceived) low-value environments;
- Uses evaluation to turn an idea into an opportunity;
- Uses evaluation to convince others that what one is doing is a low-risk activity, whilst still being valuable;
- Involves performing entrepreneurship through mediating wittingness, technical skill and interpretive skill;
- Includes curating or balancing the perceived risk and value for all people involved;
- Builds value through high-risk activities.

As I finish writing this chapter, I embark on a new stage in my Digital Arts Entrepreneurship journey, one that involves numerous emerging points, such as navigating complex legal issues and understanding investment. However, I will leave these issues for another chapter.

Because once again, I've got that nagging feeling. It's time to move on.

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References

Alarcon-Diaz X, Askaroff K, Candy L, Edmonds E, Faram J, Hobson G (2014) Evaluation in public art: the light logic exhibition. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 187–208

Auslander P (1999) Liveness: performance in a mediatized culture. Routledge, London

Bateson G (1955) A theory of play and fantasy. Psychiatr Res Rep 2:39–51

Benford S, Crabtree A, Reeves S, Flintham M, Drozd A, Sheridan J, Dix A (2006) The frame of the game: blurring the boundary between fiction and reality in mobile experiences. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'06). ACM Press, New York, pp 427–436

Candy L (2014) Evaluation and experience in art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 25–48

Davidsson P (2004) Researching entrepreneurship. Springer, New York

Dix A, Sheridan JG, Reeves S, Benford S, O'Malley C (2005) Formalising performative interaction. In: Proceedings of the 12th (DSVIS 2005), Lecture notes in computer science. Springer, London, pp 15–25

Down S, Reveley J (2004) Generational encounters and the social formation of entrepreneurial identity: 'Young Guns' and 'Old Farts'. Organization 11:233–250

Down S, Warren L (2007) Constructing narratives of enterprise: clichés and entrepreneurial self-identity. Int J Entrep Behav Res 14(1):4–23

Flintham M, Benford S, Anastasi R, Hemmings T, Crabtree A, Greenhalgh C, Tandavanitj N, Adams M, Row-Farr J (2003) Where on-line meets on-the-streets: experiences with mobile mixed reality games. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI 2003). ACM Press, New York, pp 569–576

Gartner WB (2007) Entrepreneurial narrative and a science of the imagination. J Bus Ventur 22(5):613–627

Giannachi G (2004) Virtual theatres: an introduction. Routledge, London

Goffman E (1974) Frame analysis: an essay on the organization of experience. Harper & Row, New York

Goldberg R (2001) Performance art: from futurism to present. Thames & Hudson, London

Hill R, Levenhagen M (1995) Metaphors and mental models: sensemaking and sensegiving in innovative and entrepreneurial activities. J Manag 21:1057–1074

Hill L, Paris H (2001) Guerilla performance and multimedia handbook. Continuum International, London

Jacucci G (2004) Interaction as performance: cases of configuring physical interfaces in mixed media. PhD Thesis, University of Oulu

Jones G, Wadhwani RD (2006) Entrepreneurship and business history: renewing the research agenda. Harvard Business School, Cambridge

Koleva B, Taylor I, Benford S, Fraser M, Greenhalgh C, Schnadelbach H, vom Lehn D, Heath C, Row-Farr J, Adams M (2001) Orchestrating a mixed reality performance. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI'01). ACM Press, New York, pp 38–45

Loke L, Khut G (2014) Intimate aesthetics and facilitated interaction. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 91–108

Mainstone D (2009) Addressing the unexpected. In: Proceedings of the seventh ACM conference on Creativity and Cognition (CC'09). ACM Press, New York, pp 475–476

Peverelli PJ, Song J (2012) Chinese entrepreneurship: a social capital approach. Springer, Berlin/Heidelberg

Reeves S, Benford S, O'Malley C, Fraser M (2005) Designing the spectator experience. In: Proceedings of the SIGCHI conference on human factors in computing systems (CHI 2005). ACM Press, New York, pp 741–750

Rush M (1999) New media in late 20th-century art. Thames & Hudson, New York

Saltz D (1997) The art of interaction: interactivity, performativity, and computers. Aesthet Art Crit 55(2):117–127

Schimmel P (1998) Out of actions: between performance and the object 1949–1979. The Geffen contemporary at the museum of contemporary art. Thames & Hudson, Los Angeles

Sheridan JG (2006) Digital Live Art: mediating wittingness in playful arenas. PhD Thesis, University of Lancaster

Sheridan JG, Bryan-Kinns N (2008) Designing for performative tangible interaction. Int J Arts Technol. Special Issue on Tangible and Embedded Interaction. ISSN 1754-8853, pp 288–308

Sheridan JG, Dix A, Lock S, Bayliss A (2004) Understanding interaction in ubiquitous guerrilla performances in playful arenas. In: People and computers XVIII – design for life (HCI 2004). Springer, London, pp 3–17

Sheridan JG, Bryan-Kinns B, Bayliss A (2007) Encouraging witting participation and performance in digital live art. In: Proceedings of the 21st British HCI Group annual conference on people and computers: HCI…but not as we know it (BCS-HCI'07). British Computer Society, Swinton, pp 13–23

Silver J (2009) Nature as interface: MacGyver'ing and Martha-Stewart'ing interactivity with trees, pencils, grandpa, even the kitchen sink. In: Proceedings of the seventh ACM conference on Creativity and Cognition (CC'09). ACM Press, New York, pp 483–484

Turnbull D, Connell M (2014) Curating digital public art. In: Candy L, Ferguson S (eds) Interactive experience in the digital age: evaluating new art practice. Springer, London, pp 221–241

Williams S (2010) A rhetorical theory of transformation in entrepreneurial narrative: the case of The Republic of Tea. In: Gartner W (ed) Entrepreneurial narrative theory ethnomethodology and reflexivity. Clemson University Digital Press, Clemson

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